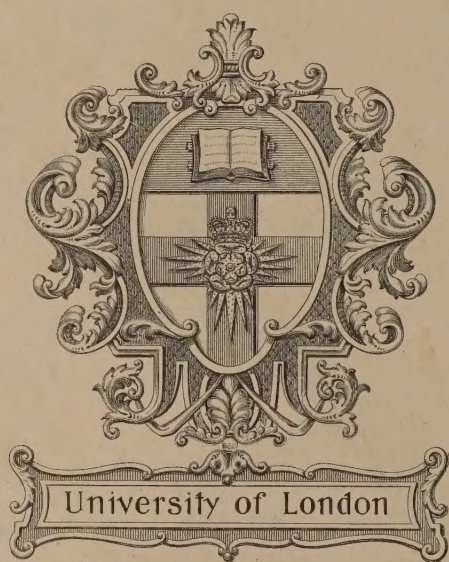
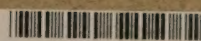
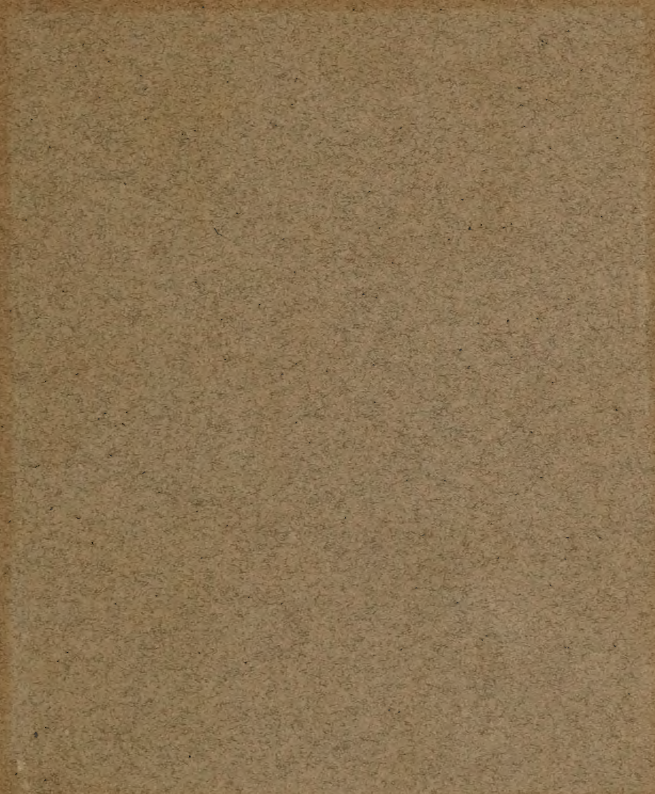






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ACCOUNTS AND PAPERS:

FORTY-EIGHT VOLUMES.

— (17.) —

EAST INDIA.

MISCELLANEOUS: CHINCHONA PLANT;
COAL FIELDS; COORG (RAJAH OF);
ELECTRIC TELEGRAPHS; OUDE CLAIMS.

Session

5 February — 28 July 1863.

VOL. XLV.

1863.

ACCOUNTS AND PAPERS:

1863.

FORTY-EIGHT VOLUMES:—CONTENTS OF THE SEVENTEENTH VOLUME.

N.B.—*THE* Figures at the beginning of the line, correspond with the N° at the foot of each Paper; and the Figures at the end of the line, refer to the MS. Paging of the Volumes arranged for *The House of Commons*.

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from March 1852 to March 1863.”

India Office, }
18 March 1863. }

E. D. BOURDILLON,
Secretary, Public Department.

(*Mr. William Ewart.*)

Ordered, by The House of Commons, to be Printed,
20 March 1863.

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COPY of CORRESPONDENCE relating to the Introduction of the CHINCHONA PLANT into *India*, and to Proceedings connected with its Cultivation, from March 1852 to March 1863.

— No. 1. —

From the Governor General of India to the Court of Directors of the East India Company.

Honourable Sirs,

Fort William, 27 March 1852.

WE have the honour to submit the accompanying letter from the Government of Bengal, with its enclosures, and to recommend for the early consideration of your honourable Court the proposal therein made for deputing a qualified gardening collector from England to South America, to procure an ample supply of seeds and young plants of the best species of the quinine-yielding cinchonas, with a view to their introduction into India.

We have, &c.
(signed) *Dalhousie.*
F. Currie.
J. Lowe.

— No. 2. —

MINUTE recorded at a Revenue, Judicial, and Legislative Committee of the Directors of the East India Company, 16 June 1852.

THE Committee having had before them a letter from the Government of India in the Public Department, dated the 27th March (No. 18) 1852, with its enclosures, recommending compliance with the proposal of the Governor of Bengal for deputing a gardening collector from England to South America for the purpose of procuring a supply of seeds and plants of the best specimens of the quinine-yielding cinchonas, with a view to their introduction into India, — Ordered, that the above papers be referred for the consideration of Dr. Royle, with a request that he will furnish this Committee with his sentiments as to the measure therein recommended, together with his opinion as to the probable expense of carrying it into execution.

— No. 3. —

REPORT on the Introduction into *India* of the Quinine-yielding Cinchonas, or Peruvian Bark Trees, by Dr. *Royle*.

India House, 27 June 1852.

AMONG the vast variety of medicinal drugs produced in various parts of the world, there is not one, with probably the single exception of opium, which is more valuable to man than the quinine-yielding cinchonas. The great value of Peruvian bark as a medicinal agent was universally acknowledged very shortly after it became first known in Europe. Its utility and employment have been greatly increased ever since its active principle has been separated in the form of quinine. So great indeed has the consumption increased, and so little care

has been bestowed upon the preservation of the natural forests, that great fears have been entertained that the supply might altogether cease, or be obtainable only at a price which would place it beyond the reach of the mass of the community.

The Bolivian Government seem of late to have become more sensible of the value of their bark, but the measures adopted seem directed rather to the enhancement of its price than to the continued preservation of its supply. For a national bank of bark has been established since January 1850, "with sufficient funds to give regularity to the bark trade," "purchasing it in the interior of the country at a fixed price," and "selling it abroad at the value due to an article of exclusive production in the woods of Bolivia, and of the first necessity and great demand in the trade of the world." "The free export of bark," it is stated, "would be fatal to our commerce," as "bringing down the price." "Consequently the bank maintains the monopoly, and with it the high value and price of bark."

Such measures, if unaccompanied by any attempts to preserve the forests, will certainly enhance the price to all, without any assurance of an increased supply being obtainable for the continually increasing demand. The bark collectors, who are usually employed by contractors, search out for new localities as the old ones become exhausted; cut down the trees and remove the bark, but take no care of planting or sowing seeds for future supplies, and the cinchona forests, like the teak forests of India, have become exhausted in many places, and will be so unless timely measures are adopted.

The introduction into other countries having suitable localities and climate for so valuable a tribe of plants, could not fail to be of advantage to such countries, not only for home consumption, but also for export commerce. To the Indian Government a home supply of a drug which already costs about 7,000 *l.* a year, would be advantageous in an economical point of view, and invaluable as affording increased means of employing a drug which is indispensable in the treatment of Indian fevers, and a deficient supply of which, in consequence of the probably much increased expenditure, is so much apprehended by the Medical Board of Bengal as to form "a real and cogent reason for regulating, by all justifiable means, the expenditure of this valuable drug, and this irrespective of the high price of the article."

The probability of entire success in the cultivation of the cinchona trees in India seems to admit of hardly any doubt, if ordinary care is adopted in the selection of suitable localities. I myself recommended this measure many years ago, when treating of the family of plants to which the cinchonas belong. I inferred from a comparison of soil and climate with the geographical distribution of cinchonaceous plants, that the quinine-yielding cinchonas might be cultivated on the slopes of the Neilgherries, and of the Southern Himalayas, in the same way that I had inferred that Chinese tea plants might be cultivated in the Northern Himalayas. It is to the above opinion that Dr. Falconer alludes, and with which he coincides.

The probability of success being great, and the introduction of the quinine-yielding cinchonas having been strongly recommended by the several authorities in Bengal, I have no hesitation in stating that after the Chinese teas, no more important plants could be introduced into India. The measures to be adopted for this purpose would, however, require great care and consideration. For though cinchona, or, as it is commonly called, Peruvian bark, has been so long esteemed as a medicine, the plant yielding the most valuable kind of yellow bark has only been discovered within the last two or three years. This in consequence of the investigations of Mr. Weddell, an English surgeon, who accompanied the French scientific expedition of M. de Castelnau into the interior of Brazil and Peru. From him we have the most accurate information respecting the extent and localities, the destruction and gradual disappearance of the nearer forests, as well as his opinion that the most valuable kind of cinchona will probably altogether disappear as an article of commerce.

Useful and quinine-yielding cinchonas are, however, found in the neighbourhood of Santa Fe de Bagota. The pale barks in forests near Loxa, the most valuable, or yellow bark tree (*Cinchona Calisaya*) in the interior of Bolivia, about the latitude of La Paz; and the red bark from near Lima, or from 11 degrees of north, to about 20 degrees of south latitude, is the extent of distribution of these valuable plants along the Andes; but the useful species do

not

not extend much to the eastward. The operations of a collector would therefore require to be turned chiefly to the western coast of South America, from whence he could make incursions into the interior to collect seeds or plants, and convey them to the coast for shipment to Europe or India.

It is evident that such measures could not be adopted, without exciting considerable attention, and I believe jealousy, if we consider the late proceedings of the Bolivian Government. But an agent who had some other objects in view, might safely carry on his operations along the whole coast, and have his time fully occupied. I am happy to be able to suggest a measure which will, I have every confidence, be effective, at the same time that it is economical.

The Horticultural Society of London have for some time had it under consideration to send a gardening collector to the west coast of South America for the purpose of visiting the mountain ranges which run along the coast, and collecting such seeds and plants as are likely to be of value in this country. It was only at the last meeting of the council that directions were given to make inquiries respecting the most suitable person. I would recommend that the person employed by the Horticultural Society should be engaged also to collect seeds and plants of the quinine-yielding cinchonas in the different localities which I have indicated, not as a secondary measure, but as one of his principal objects, which I believe would be best effected while he was ostensibly employed in making more general collections. The expenses of such a collector has been from 400 *l.* to 500 *l.* a year, and they need not exceed the latter sum on the present occasion. If one half of such expenses were paid by the Honourable Court, I feel no doubt that the objects in view might be as successfully attained as by employing a separate collector. If authorised, I should be happy to make the necessary arrangements.

(signed) *J. Forbes Royle, M.D.*

— No. 4. —

From the Secretary at the India House to the Secretary, Board of Control.

Sir,

East India House, 7 October 1852.

1. I AM commanded by the Court of Directors to forward to you the accompanying copy of a public letter from the Government of India, dated the 27th March last, No. 18, and of its enclosures, on the subject of obtaining a supply of seeds and young plants of the quinine-yielding cinchonas of South America, with a view to the cultivation of the tree in India.

2. The accompanying papers set forth at length the grounds of the proposal submitted by the Government of India; and the Court, being of opinion with reference to the augmented demand for quinine in India, and to the large and increasing amount (7,000 *l.*) annually paid for that drug for consumption there, that the introduction of the proper genus of the cinchona into India, several localities of which are stated to be well suited for its cultivation, is a highly desirable measure, are prepared to take immediate steps for the accomplishment of the object.

3. It appears to the Court that the most simple mode of proceeding will be to obtain the necessary supply of seeds and plants through the instrumentality of Her Majesty's Consular Agents; and I am directed to request that, if the Board concur in this opinion, they will take measures for ascertaining from the Earl of Malmesbury, in the first place, whether his Lordship is aware of any peculiar difficulties likely to impede the attempt to procure specimens of the plants in question; and secondly, if no such impediments are believed to exist, whether his Lordship will be willing to empower Her Majesty's Consuls in Bolivia, and the other South American States, to take measures for procuring the seeds and plants required.

4. In the event of a favourable reply being returned by Lord Malmesbury on these points, the Court will be prepared, if his Lordship thinks it desirable, to supply, for transmission to the various Consuls, copies of Dr. Falconer's

memorandum on the subject, that document containing all the requisite information as to the plants to be sought for, and as to the best means of transmitting to India such specimens as may be procured.

C. L. Cumming Bruce, Esq., M. P.
&c. &c. &c.
India Board.

I have, &c.,
(signed) *James C. Melvill*,
Secretary.

— No. 5. —

From Dr. *Forbes Royle* to *J. C. Melvill*, Esq., Secretary to the Court of Directors of the East India Company.

Sir,

East India House, 14 December 1852.

THE Indian Government having recommended the introduction of the true cinchona plant for cultivation in suitable localities in India, and measures being in progress for forwarding this important object, I have thought it desirable to endeavour to obtain some plants from the different botanic gardens, which I knew had been raised from seed collected by Dr. Weddell, the discoverer of the true cinchona plant, as that yielding the best yellow bark.

I am happy to say that Dr. Balfour, of the Edinburgh Botanic Gardens, informs me that he has some plants ready for despatch, and which will arrive here in a few days; also that the Horticultural Society, and the Royal Botanic Gardens at Kew, may be able to add a few additional plants.

As it is very desirable to send these valuable plants under safe and careful custody, I beg to suggest that advantage be taken of Mr. Fortune's departure for China by the next mail; and that he be authorised to take charge of the box containing plants as far as he proceeds on the course to India. Freight will probably be charged upon the box, as it will not probably be included as a part of Mr. Fortune's baggage; but all the expenses will necessarily be trifling in amount.

I have, &c.,
(signed) *J. Forbes Royle*, M. D.

— No. 6. —

MINUTE.

At a Revenue, Judicial, and Legislative Committee of the Court of Directors,
15 December 1852.

THE Committee having before them a letter from Dr. Royle, dated the 14th inst., reporting that he has succeeded in procuring from the Horticultural and Botanical Gardens in this country, a few plants of the true cinchonas, which it is desired to introduce into India, and that Mr. Fortune is willing to take charge of the same, as far as he can, on his way to China.

Ordered, that Mr. Fortune be authorised to take charge of the plants in question, and to incur such charges for freight, and other incidental expenses, as he may find to be necessary, on account of them.

— No. 7. —

From Dr. *Royle* to Sir *James Melvill*, K.C.B., Secretary to the Court of Directors of the East India Company.

Sir,

East India House, 3 January 1854.

I HAVE the honour to report the arrival of some cinchona plants and seeds sent through the Foreign Office by Her Majesty's Consul in the State of Equator. Mr. Cope writes on the 31st of October 1853, that he had transmitted to the Earl of Clarendon a box containing plants of the yellow cinchona bark of

Mr. Cope forwarding cinchona plants.

of Cuenca, and also plants, flowers, and seeds of the Crown cinchona bark of Loxa. These arrived at the India House on the 22d of December. On opening the box, I found that the plants and seeds had all been packed up in damp moss, which, though useful in preserving the former, is almost sure to destroy the vegetative power of seeds. I therefore immediately sent them down to the Horticultural Society's garden, at Chiswick, as the only likely place where I could be sure of their being carefully managed, so as to preserve them if possible, and saw them myself carefully unpacked on the 23d. Some of the upper layer of plants were dry and quite dead; those lower down damp, and apparently alive; the seeds all damp, indeed soaking in wet, but being contained within their capsules, it is possible some may vegetate, as their native climate is damp, and they must often lie for some time before they vegetate. I saw the plants again yesterday, but though alive, it is impossible at present to say whether any will survive, or any of the seeds vegetate.

On arrival sent to Chiswick garden.

Though Mr. Cope mentions the yellow bark, I doubt if this can be anything more than one of the substitutes for that most valuable of the barks. But the grey cinchona is one of the valuable kinds, and would probably yield returns four or five years after it is established in the mountains of India.

Yellow? of Cuenca. Crown bark of Loxa.

Mr. Sullivan, Her Majesty's Chargé d'Affaires in Peru, writes from Lima, that having no means there of procuring seeds of cinchona plants he had addressed himself to Mr. Crompton, Her Majesty's Vice-consul, at Islay and Arica.

Mr. Sullivan writes to Mr. Crompton, who promises seeds of yellow bark.

Mr. Crompton writes from Islay, 18th October, that having proceeded to Arequipa, he there found that the only means of accomplishing the object in view would be through one of the bark collectors employed in the interior, by the house of Gibbs & Co., "as it would be impossible from the jealousy of these people to accomplish a successful result, if they conceived the British to be interested." He however states, that Mr. Stubbs, managing partner of Messrs. Gibbs' house, at Arequipa, had agreed to send a person into the Montana to endeavour to get some seeds, and from a private communication to that gentleman from his agent, there appear hopes of getting some of the seeds in about April and May.

Of the seeds of the true yellow bark which, through the kindness of Mr. Pentland, I was enabled to send to the Calcutta Botanic Gardens, I am sorry to say that none have vegetated; but of the six plants contributed by the Royal Botanic Gardens at Kew and Edinburgh, and by the Horticultural Society, four, I am happy to say, that Dr. Falconer writes that they are doing well, as well as four cuttings which Mr. Scott, the gardener, has obtained from them.

Cinchona plants in Calcutta.—B. G.

As the present reliance for seeds of the calisaya, or true yellow bark, is upon the private firm at present engaged in the very traffic which may be interfered with, though certainly not for some time with regard to the thick yellow bark, I would beg leave to suggest that I may be authorised to endeavour to get seeds through other sources also. For instance, I am acquainted with a gentleman (Mr. Bollaert), who is well known to some of my friends, and who was formerly assistant in Dr. Faraday's laboratory, and who has been recently deputed to Peru to inquire into some of its mineral products. I have no doubt that if he was authorised to incur some moderate expense in procuring the seeds of these calisaya plants (of which we could not have too many), he would be able to do so, and without exciting any suspicion while engaged in other pursuits. I would therefore request to be authorised to enter into a correspondence with him on the subject, guaranteeing him any expenses he may incur in procuring these seeds, if he should be in the neighbourhood of where the best plants grow. The expense would not be greater than that to be incurred through the foreign consuls, and the object is of great importance to secure so important a culture for India, save great expense in the supply of so expensive a drug for the Indian Government, besides being for the general benefit that such valuable drugs as the cinchona barks, and their alkalis, quinine and cinchonene, should not be confined to one or two localities where no care is taken in preserving the forests.

Application for leave to authorise Mr. Bollaert, now in Peru, to collect cinchona seeds.

I have, &c.

(signed) J. Forbes Royle, M.D.

— No. 8. —

From Mr. Melvill to Sir T. Redington.

Sir,

East India House, 5 January 1854.

I AM commanded to forward copy of a resolution passed by the Court of Directors of the East India Company on the 4th instant, proposing to authorise Dr. Royle to communicate with Mr. Bollaert, who has recently been deputed to Peru, upon the subject of a supply of seeds of the calisaya, from which quinine is obtained, and to guarantee to him the repayment of any expenses he may incur in collecting the seeds to the extent of fifty pounds (50*l.*), and I am desired to request that you will submit the said Resolution for the approval of the Board of Commissioners for the affairs of India.

I have, &c.

(signed) James C. Melvill, Secretary.

— No. 9. —

From Thomas Thomson, Esq., M.D., Superintendent H. C. Botanic Garden, to W. Grey, Esq., Secretary to the Government of Bengal; dated 14 May 1855.

Sir,

IN obedience to the instructions contained in your office memorandum, dated the 21st ultimo, calling for a report on the seeds and plants of the quinine-yielding cinchonas sent out by the Honourable Court in 1852, I have the honour to forward a copy of a letter addressed by my predecessor, Dr. Falconer, to the Secretary of the Medical Board, embodying all the information which exists in this office regarding the cinchona trees.

2. I regret to say that I have just been informed by Dr. Campbell, superintendent of Darjeeling, that the three cinchona trees there were killed by the cold of last winter. I have the honour to forward a copy of Dr. Campbell's communication to that effect in reply to a letter which I addressed to him on receipt of your memorandum.

3. I fully concur with Dr. Royle and Dr. Falconer in believing that the climate of the Eastern Himalaya will be found well suited to the growth of cinchona, and I do not think that the failure of the first attempt to introduce this valuable plant ought in the least to deter us from further trial.

4. I shall communicate the loss of the cinchona plants at Darjeeling by the first mail to Dr. Royle, for the information of the Honourable Court, in the hope that a further supply of young plants will be sent out as soon as possible to renew the experiment.

I have, &c.

(signed) Thomas Thomson, Superintendent.

Enclosure to No. 9.

From H. Falconer, Esq., M.D., Superintendent H. C. Botanic Garden, to J. Macpherson, Esq., Secretary, Medical Board, dated 9 April 1855.

Sir,

I HAVE the honour to acknowledge the receipt of your letter, dated the 19th ultimo, soliciting information for the Medical Board, regarding cinchona plants which were received in the Botanic Garden from England; I shall reply to the Board's questions in the order in which they have been put.

1. The plants were brought to India overland, in a Ward's glazed case, under charge of Mr. Robert Fortune, who was then *en route* to China. The cases were transported across the desert without damage of any kind, although hurried along with the passengers.

2. Seeds

2. Seeds of the *Cinchona Calisaya* of Dr. Weddell, who gathered them in South America, were procured by Dr. Royle, and transmitted to the Botanical Garden here, but although watched with the utmost care by the European head gardener, none of them showed the slightest disposition to germinate.

3. Only six plants were despatched, of which five were alive. They were retained in the Botanic Garden through the hot weather and rains in conservatory cases, with the object of propagating from them. They bear pruning of all kinds very ill, and were in consequence but very sparingly wounded. The buds survived for a very long time, but never struck root, and finally perished. The original plants did not thrive well in the Botanic Garden, the climate of which is much too hot for *cinchona calceyana*.

4. The original surviving plants were sent to Darjeeling, where three of them arrived alive. But the period of trial has been too short, and the plants were too unfavourably placed to admit of any decided opinion. The experiment ought to be tried with more materials, and a wider range of elevation than was practicable in this case.

5. I submitted an opinion to Government about four years ago, that it was feasible to grow *cinchona* successfully in India for medical purposes, and I have seen no reason since to alter that opinion. But the experiment must be conducted upon a sufficiently large scale to admit of a full trial, and with a wide range of the different species; *cinchona condanonia* is one of the species that promises most favourably.

6. The best information on the subject is contained on a monograph on the genus *cinchona*, by Dr. Weddell, who was deputed by the French Government to South America for the express object.

7. I enclose an extract from Dr. Royle's *Materia Medica*, second edition, which contains a good epitome of what is known up to the present moment.

I have, &c.
(signed) H. Falconer, M.D., Superintendent.

— No. 10. —

From the Government of India to the Honourable the Court of Directors of the East India Company.

Honourable Sirs,

Fort William, 2 June 1855.

WITH reference to the 39th paragraph of your Honourable Court's Despatch, No. 44, of 1853, dated the 6th July, we have the honour to transmit the accompanying correspondence regarding the result of the experiment for the introduction of the *cinchona* plant into India. The seeds are reported to have failed and the plants to have died.

To Government of Bengal, dated 17 April 1855.
From ditto, No. 602, dated 17 May; and enclosures.

2. Both Dr. Falconer and Dr. Thomson, the late and present superintendents of the Botanic Garden, consider that the failure of the first experiment, which was on a very small scale, should not deter the Government from a second and more extensive trial, and they hold to the opinion that the climate of the Eastern Himalayas is well suited to the growth of the plant. Under these circumstances, and referring to the interest attaching to the successful introduction of the plant into India, we beg to recommend the trial of a further experiment, and on a larger scale than the last.

We have, &c.
(signed) J. A. Dorin.
J. Low.
J. P. Grant.
B. Peacock.

— No. 11. —

EXTRACT, from Dr. Royle to Sir J. C. Melville, K. C. B., Secretary to the Court of Directors of the East India Company.

Sir,

9 August 1855.

IN the first place, E. W. Mark, Esq., H. B. M. Vice-Consul at Bagota, having written to me respecting his readiness to assist again in the attempt to introduce into India the different species of *cinchona*, yielding what are commonly called

Cinchona plants for India.

called Peruvian barks, I have written him the enclosed, and forwarded a note from Dr. Weddell, the highest authority we have on this subject. As it is seldom that any seeds or plants are obtained through the aid of consular agents, I think it the more desirable to take advantage of Mr. Mark's offer of his services, as all that is usually required of an individual on the spot is, that he should take a personal interest in the matter, and see that the instructions sent are carefully attended to. As some expense may be incurred, though not more than originally contemplated, I have thought it proper to forward the correspondence through you. I still continue to think that the successful introduction into India of the cinchonas will be of great benefit, not only to that country, but to the world in general, as there is great fear that the supply from the original sources may become so much diminished as to be beyond the reach of the mass of those who require the aid of quinine. The Dutch Government continue to pursue active measures for establishing the culture of the *Cinchona Calisaya* (the best species), and Dr. De Vry, the Dutch Commissioner here, has been directed to inquire of me the result of the experiments making in India.

2. By a remarkable coincidence, to which I trust I may refer, I had written thus far when a note from Dr. Thomson, Superintendent of the Botanic Garden at Calcutta, reached me, by which I regret much to learn that the *Cinchona Calisaya* sent out by the Court two years ago all died on their removal to Darjeeling. The loss is, I fear, irremediable, as Dr. Weddell informs me that, without a special agent, he does not believe it possible to procure fresh seeds or plants. It is the more desirable, therefore, that the consuls at Bagota and at Guayaquil should be requested to repeat their efforts to send living plants and carefully dried seeds of the best plants near those localities.

— No. 12. —

MEMORANDUM by Dr. Royle.

East India House, 31 March 1856.

THE accompanying letter from the Government of Bengal, dated 2d June, 1855, reports the failure both of the seeds and of the plants of the quinine-yielding cinchona, which had been sent out to Calcutta in consequence of the former application. It further states that both Dr. Falconer and Dr. Thomson, the late and the present superintendents of the Calcutta Botanic Gardens, consider that the failure of the small experiment should not deter from a second and more extensive trial, and they hold to the opinion that the climate of the Eastern Himalayas is well suited to the growth of the plant. I myself continue of the same opinion as I have been for many years; indeed, recommended the culture of these cinchonas in the above locality more than 20 years ago.

But I would beg to observe that the experiment which has failed was never intended to be the sole, or, indeed, principal one, but rather auxiliary to it.

When the original proposal arrived for the introduction of the true quinine-yielding cinchona into the Eastern Himalayas, I wrote a memorandum, recommending, in consequence of the difficulties of the undertaking and the jealousy of the local governments, that a person who had other objects of a similar kind in view should be employed, and as the Horticultural Society of London proposed sending a plant collector to the American mountains, I suggested that he might be well employed in introducing the seeds and plants of the desired cinchonas at the same time. As the proposal was not approved of, it was not proceeded with. The Horticultural Society's plant collector, Mr. Bottari, is now on his return from the mountains of Mexico, and I know of no suitable person at present who could be recommended for employment.

In order to endeavour to get some seeds and plants of these cinchonas through Her Majesty's Consuls, I wrote the second of the accompanying papers; and the results which had been obtained were reported in my letter dated 4th January 1854, which amounted only to Mr. Mark having been unable to bring with him alive the cinchona plants, which he had collected at Bagota, while Mr. Cope from Guayaquil sent some young plants and seeds in

wet

wet moss, and packed up in a box. These, as might be expected, did not vegetate. On this occasion I applied for 50 *l.*, to be advanced to Mr. Bollaert, who was being dispatched from this country to the American coast, in order that he might, if possible, get some cinchona seeds; but he left the country before I had an opportunity of making arrangements with him.

The experiment which was made was a small one; it consisted of a few plants which I was able to obtain from the Botanic Gardens of Kew, of Edinburgh, and of the Horticultural Society at Chiswick; and the seeds were some old ones which had been collected by Dr. Weddell, in one of his trips to South America, and from whom the first seeds had been obtained from which the above plants had been grown in the Botanic Garden, proving that the seeds, if carefully gathered and dried, would retain their vegetative properties sufficiently long to grow when sown in this country, perhaps also even when sent to India.

Though I do not know at present of any method which is likely to succeed in getting the best kind of yellow bark, that is, the calisaya, from Bolivia, there are two or three species which are very valuable for medicinal purposes, in the neighbourhood of Quito and Loxa; and I have lately learnt that there is a gentleman at present in Quito (Dr. Jamieson) who employs himself at his leisure in collecting seeds and dried plants for his scientific friends in Europe. I believe his services might be obtained; and if I was authorised to write to him, to enable him to incur some expense, say about 50 *l.*, and say that an equal sum shall be given to him on the successful execution of the Commission with which he should be charged, I shall be disposed to think that considerable quantities of the seeds of the species of cinchona common in that part of America might be certainly secured.

(signed) *J. F. Royle, M. D.*

— No. 13. —

EXTRACT.

From the Governor of India to the Honourable the Court of Directors of the East India Company.

Honourable Sirs,

10 November 1856.

IN continuation of our Letter, No. 40 of 1855, dated the 2d June, respecting the experimental introduction of the quinine-yielding cinchona tree of South America into India, we have the honour to transmit for your Honourable Court's consideration the accompanying copy of a Minute by the Governor General, dated the 20th ultimo.

2. We earnestly recommend this subject to your Honourable Court's early and careful attention; and we hope to be made acquainted with the views of your Honourable Court on the proposals made in the Minute, and with the measures it may be determined to take in consequence, in order that timely inquiries may be completed in India, as to the sites on which the plants, when received, may best be cultivated.

Enclosure to No. 13.

MINUTE by the Governor General, concurred in by the Members of Government;
dated 20 October 1856.

THIS important subject engaged the attention of the Government of India, on the representation of the Agricultural Society, made to the Government of Bengal in 1852; and in consequence of a communication made to the Honourable Court of Directors, some seed and plants were procured, and sent out to India.

Introduction of
the cinchona tree
of South America
into India.

The experiment unfortunately failed, the seeds having in no instance germinated, and only five plants having reached Calcutta alive. These last, after having been kept at the Botanical Gardens during a rainy season, were sent to Darjeeling, where they were killed by the cold of the following winter.

In 1855 the Medical Board took up the question again; but their report by some accident not having been received, a duplicate has been called for, and at the same time the Agricultural Society have again addressed the Government.

The proposals of the Medical Board and of the Agricultural Society are, first, that the experiment of introducing cinchona plants should be tried upon an extensive scale, with several species of the plants, and in many parts of the country, especially in the Neilgherries, in the range to the east of Sylhet, at Chittagong, in the Tenasserim Provinces, and in the neighbourhood of Darjeeling.

That an establishment under the orders of a person properly qualified be deputed to collect cinchona plants of the best species (the seeds being too delicate to survive the voyage), and to despatch them in "Ward's cases" from Trinidad or Demerara direct to Calcutta and Madras, so as to arrive in India not later than November.

That officers possessing the requisite botanical and geological knowledge should be deputed to inquire as to the sites best calculated to receive the plants; that these officers, duly supplied with all aids and appliances, should receive the plants upon arrival, and convey them to the selected spots.

That considerable reward should be offered to native gardeners employed under these officers, to encourage them to attend to the plants with the necessary assiduity.

I submit that the substance of these proposals should be recommended to the favourable consideration of the Honourable Court. The supply of South American cinchona is actually threatened with extinction; the consequences of the loss of this most valuable febrifuge would be most lamentable, and the experiment, if successful, would introduce into India an article which would be largely exported, and would be the source of a considerable revenue.

The experiment already tried affords no sort of criterion as to the possibility of a successful introduction of the cinchona into India.

The plants appear to have received precisely that treatment which would make their growth impossible, having first been subjected to the heat and moisture of Bengal, and then transferred to the cold climate of Darjeeling, without, as it would seem, having been placed at the latter place under competent care.

The experiment, carried out in the manner proposed, will be costly; but it is shown in these papers that in five years the Government of India has expended nearly 54,000*l.* in quinine and cinchona bark, and therefore I believe that success will be well worth the cost; and looking to the political condition of the countries in which the plants are to be found, I doubt whether they can be surely procured in any other way.

There is good reason to hope that the cinchona may thrive in India. The reasons of this are fully set forth in the letters of the Medical Board and of the Agricultural and Horticultural Society; moreover, the opinions of all the gentlemen who have given their attention to the subject are the same, not only as to the desirableness of introducing the cinchona, but as to the possibility of so doing.

Under these circumstances, and considering the incalculable benefits to be derived from having a native supply of this most valuable medicine at hand, I am of opinion that the experiment as proposed should be fairly tried, and that the Honourable Court should be moved at once to send a properly qualified collector to South America, to collect and bring to India the best species of cinchona.

It is probable that the person so employed might conveniently take advantage of emigrant vessels returning from Demerara and Trinidad to Madras and Calcutta. As the mission to South America will occupy some time, I do not propose that any steps should be taken towards ascertaining the sites in this country best suited to the plants, until the Honourable Court shall have expressed their views upon the present proposal.

It is some incentive to the measure that the Dutch Government have already adopted it in Java, where after a considerable loss in plants it is reported to promise success.

The plants were received in Java in 1854; and I propose that the Resident at Singapore be directed to address the Governor General of Batavia, with the view of obtaining from his Excellency any information or suggestions which the recent experience of the authorities in that island may enable them to offer, both as to the parts in South America where the best plants should be sought, and as to their culture in the East.

20 October 1856.

(signed) *Canning.*

We quite agree.

23 October 1856.

(signed) *J. A. Dorin.*

2 November 1856.

J. P. Grant.

5 November 1856.

B. Peacock.

— No. 14. —

From *H. Piddington*, Esq., to *C. Beadon*, Esq., Secretary to the Government of India.

Sir,

24 November 1856.

LEARNING from the public papers that the Government is desirous of introducing the cinchona bark tree into India, I beg respectfully to submit in aid of its efforts the accompanying memorandum, from the which his Lordship will perceive that there are important considerations to be kept in view besides the mere obtaining of plants or seeds, and that the neglect of one of these may have been the cause of the failure of the plants brought out by Mr. Fortune, and sent to Darjeeling. A glance at the accompanying memorandum in aid of the introduction of the Carolina rice will satisfy his Lordship that these subjects are not unfamiliar to me.

2. It would seem also that the Government is not aware that the extract of the "golunchee," a common hedge and forest plant all over India and the Eastern Islands, is, for natives, if not a complete substitute for quinine, something very near to it, and for Europeans it is certainly a very powerful adjunct, so that I have no hesitation in saying, and this on the authority of many medical friends, that at least one-half of all the quinine now expended in India either by the Government or by private individuals, might be economised at a very moderate charge.

3. It is not here the place to enter further into the merits of this invaluable extract, which is well known to scientific members of the profession; but I may mention that, about two years ago, it was brought to the notice of Government and of the public as a discovery by a medical officer and a superintending surgeon in the North West Provinces, who were evidently ignorant of my previous researches of 1826 to 1828. I shall willingly furnish further details and references regarding this valuable medicine, which has been so strangely neglected of late years, if desired.

4. It will be, perhaps, some excuse to his Lordship for intruding my views on this matter to say that I have long taken a deep interest in it. I procured seed of the best cinchona from Cuba as far back as 1828, which unfortunately did not germinate. I have constantly kept the object in view, and I should probably have obtained plants through the Admiralty had Lord Auckland lived. I have given more chemical research than I like to speak of, and, perhaps, more expense than my poor means justified, for 30 years, to this one great question of humanity for India, the placing of a bottle of a cheap febrifuge of some kind within the reach of the means of the poorest ryot; and that, finally, I have now in my hands a new preparation from a common Indian plant which can be prepared at a very cheap rate, and may I hope fulfil this great object, as a medical friend speaks favourably of it so far.

I beg to place at his Lordship's disposal a small specimen of the rocky soil of the cinchona alluded to in my memorandum, as also for his satisfaction a small bottle of my new bitter vegetable salt, "Indianine."

I have, &c.

Calcutta, 24 November 1856.

(signed) *H. Piddington*.

Enclosure to No. 14.

MEMORANDUM to aid in the Introduction and successful Cultivation of the Quiniferous Cinchona Plants in India, by Henry Piddington.

Calcutta, 24 November 1856.

1. It is quite unnecessary to dissert here at length upon the imperative necessity of attention to the three great requisites for the successful acclimation and profitable product of every vegetable production; every forester, nurseryman, and herbalist knows that, from the oaks of Sussex, and the pines of Araucaria and the Jura, to the tobacco of Virginia and Cuba, and the mint and lavender of the Surrey druggists' gardens, soil, climate, and situation so govern growth and produce that deficiency or failure, in any of these three requisites entails deficiency or failure in the growth or production of the plant.

2. But I have seen with regret by the papers now published, that when the precious cinchona plants brought by Mr. Fortune were received they were all sent to Darjeeling; climate alone, and perhaps situation as to drainage, &c. being apparently considered, but the question of soil utterly neglected.

3. For we perfectly well know here (better, perhaps, even than in Europe where the labours of the Asiatic Society are little known) what the soil in which the cinchona of one part of Peru grows is composed of; for in 1831 I published the following short paper, which I copy here; it will be found in the "Gleanings in Science," vol. iii. p. 28, as part of the researches of the Physical Class of the Asiatic Society.

On the Soil in which the Cinchona thrives.—By *H. Piddington*, Esq.

(Read before the Physical Class of the Asiatic Society.)

In examining a collection of minerals from Peru, which had been sent to our worthy Vice-President, I found the following label to one of the specimens:—

"No. 76. Piedra que se encuentra en las margenes de Guallaza, Cerro de San Cristoval, legua y media N. al S. de altura considerable. La falda del este no tiene un solo arbol de quina y la opuesta esta cubierta; se cria en esta classe de piedra que esta cubierta con hojas del mismo arbol con un espesura de $\frac{3}{4}$."

TRANSLATION.

"Rock found in the neighbourhood of Guallaza, Sierra of San Cristoval, a league and a-half from N. to S., and of considerable altitude. The western slope has not a single bark tree (cinchona), and the opposite side is covered with them. They grow in this sort of rock, which is covered with their leaves to the depth of three-quarters of a yard."

Looking to the probability that this valuable tree may one day become an article of culture both in India and Australia, perhaps even in Europe, it appeared probable that an analysis of the rock might, with propriety, occupy a space in the Society's records.

It proved to be, upon examination, a decomposing granular dolomite, the exterior of which was friable, while the interior was perfectly compact.

100 Grains were found to consist of water	-	-	-	-	-	-	-	-	2.06
Siliceous matter, with some trace of vegetable matter (from the outside)	-	-	-	-	-	-	-	-	0.62
Carbonate of lime	-	-	-	-	-	-	-	-	46.00
Carbonate of magnesia	-	-	-	-	-	-	-	-	51.00
Loss	-	-	-	-	-	-	-	-	0.32
									100.00

REMARKS.

In a mineralogical point of view it is remarkable that the proportion of carbonate of magnesia far exceeds that found in those analysed in Europe, which are published in Jameson; but it is a singular physical fact that the cinchona, the most valuable medical product of the vegetable kingdom, is found to flourish on a soil so utterly destructive to every other useful product that we are acquainted with; a beautiful instance added to those which science is hourly disclosing of the beneficent economy of the universe.

I send a small specimen of the rock, the disintegration of which, we can see, would easily form a soil in which, as described on the label, small trees like the cinchona could grow. Geologically, nothing is easier than to explain how the soil in one side of a hill or mountain may be quite different from that on the other.

4. We do not, it is true, learn from this analysis whether it be the lime or the magnesia, or both, which are essential to the growth of the tree, or to the quantity of quinine produced. It may be that it simply requires lime, when any calcareous soil would suit it, but it may also require both; at all events, the soil of Darjeeling, where limestone is unknown (except a very small concretionary deposit of which I examined a specimen in 1842) does not seem to me to have been that which would have best suited the plant, while the calcareous hills of Sylhet and Cachar would at least afford it plenty of lime.

5. All that is clearly shown then is, I submit, that we want accurate information on this most essential question, to guide us; and from all one can glean from books, and from what I have learned from South American Spaniards, I should say too that the apparently capricious growths of the cinchona groves and forests, seem to be much like our own tea tracts in Assam and Cachar. Soil may be the essential element for its successful thriving;* climate cannot differ to the extent of making an abundant growth in one place and a total absence of the trees at a few miles of distance from it, while soil may do this everywhere.

See also the positive words of the label.

6. I submit

6. I submit then respectfully, for the consideration of Government, whether the agent whom it is proposed to send should not be instructed as follows:—

(a.) To collect with the plants specimens of the soils in which the trees grow (taken at a foot deep, near their roots) as also of all the rocks and even loose stones about them.

(b.) To obtain all the information he possibly can regarding climate.

(c.) To note with care the situations of the groves of the trees, as their aspects, and whether on the sides of hills or in level places, and if in dry or moist localities; for as the barks differ so much it may be that some of the varieties prefer a moist soil to a dry one.

(d.) That, if possible, a few mule-loads of the soil should be brought down with the plants, so as to fill the Ward's cases with it. If these are used, and if a few seeds are sown between the plants, there is a chance of their germinating also on the voyage, which would at least supply the place of the plants which die.

(signed) *H. Piddington.*

— No. 15. —

From the Medical Board to the Hon. *J. A. Dorin*, Esq., President in Council;
dated Fort William, 9 June 1855.

Honourable Sir,

THE entire correspondence being now before us, and the subject being one of very high importance, we beg leave to submit to your Honor's attention a brief report upon an attempt which has recently been made to introduce the cultivation of the cinchona tree into this Presidency.

2. It was long since held by Dr. Forbes Royle, that the introduction of the cinchonas into this country was highly desirable, and that the experiment would doubtless succeed in the Neilgherries.

In his work on
the productive
resources of India.

3. In September 1850, Mr. John Grant, then holding the appointment of apothecary, Honourable East India Company, addressed a communication to this Board, in which, after insisting very strongly upon the danger of a failure of the cinchona supply in America, under the annually increasing demands for the medicinal bark from nearly all parts of the world, the writer suggested, that to obviate such risk it would be expedient to introduce varieties of the cinchonaceæ into India, where the steep declivities of the spurs of the Himalaya, &c. form promising localities, where they would in all probability thrive well.

No. 97 of 13 Sep-
tember 1850.

4. In 1852, the secretary to the Agri-horticultural Society addressed a letter to the Government of Bengal, forwarding a copy of a valuable paper upon the introduction into India of the quinine-yielding cinchonas of South America, with the Society's respectful request that the most Noble the Governor of Bengal would be pleased to give the suggestions which it embodied the consideration which, they submitted, the importance of the subject deserved. In his subsequent communication upon the subject with the Home Department, his Lordship strongly supported the proposals of Dr. Falconer, and pointed to the attention of the Government of India the Medical Board's lately printed report on the treatment of fever, as showing the deficiency in the market of the supply of quinine, and the increased consumption of it which may be expected, at least in India.

23 February 1852.

No. 447 of the
9th March 1852.

5. The result of this correspondence was a communication from the Home Department to the address of the Secretary to the Government of Bengal, announcing that the proposal of deputing a qualified person from England to South America to procure seeds and young plants of the best species would be submitted to the Honourable the Court of Directors with the favourable recommendation of the Governor General in Council.

No. 289 of the
27th March 1852.

6. Early in the present year a valuable essay on the introduction of the cinchona trees into India was forwarded to us by Assistant Surgeon Thomas Anderson, M.D., F.R.S.E. It will be found that the views entertained on this subject by Dr. Anderson mainly agree with those held by Dr. Royle, Mr. Grant, and Dr. Falconer.

No. 1696 of
19 March 1855.
No. 802, 7 April
1855.

* Dr. Weddell was
deputed by the
French Govern-
ment to South
America with the
express object of
obtaining informa-
tion relative to the
cinchonaceæ.

No. 248, of
30 April 1855.

7. Previous to the departure of the last-named officer for England, we communicated with him, requesting that he would furnish us with information respecting a supply of cinchona plant which we understood had been received at the Botanical Gardens some time previously. In his reply we were informed that the plants were brought to India overland in a Ward's glazed case, under charge of Mr. Robert Fortune. They were transported across the desert without damage of any kind.

8. The seeds of the *Cinchona Calisaya*, a highly valuable species of yellow bark, containing a large proportion of quinine, although gathered by Dr. Weddell,* and forwarded by Dr. Royle, and therefore obtained under the most favourable circumstances, showed not the slightest disposition to germinate, although watched with the utmost care by the European head gardener.

9. Only six plants were dispatched, of which five were alive, they were retained in the Botanical Garden through the hot weather and rains in conservatory cases. They bore pruning very ill, and were in consequence but very sparingly wounded. The cutting survived for a very long time, but never struck root, and finally perished. The original plants did not thrive well in the Botanical Garden, the climate of which Dr. Falconer considered to be too hot for *Cinchona Calisaya*.

10. The original surviving plants were sent to Darjeeling, where three of them arrived alive.

11. Upon receipt of the above information, we requested that the Superintendent of Darjeeling would furnish us with information regarding the condition of the three cinchona trees which reached that station in safety. In his reply, Dr. A. Campbell states that all the cinchona trees were killed by the cold of last winter, and suggests that in any future trial at Darjeeling, the trees should not, he thinks, be planted at an elevation of more than 2,000 feet.

12. Unsuccessful as this experiment has proved, we would venture to submit that, considering the very limited scale upon which it was tried, and the now perfectly obvious causes of the failure which attended it, its result has by no means lessened our faith in the possibility of introducing the cinchona tree into India.

13. When it is recollected that Dr. Weddell discovered the *Cinchona Calisaya*, yielding the invaluable yellow bark of English commerce, flourishing abundantly in the cinchona regions of Bolivia and a part of Peru between 19° and 13° of south latitude, and that the corresponding parallels of the Eastern hemisphere include the Neilgherries and that great chain of hills which extends from Muneepore to Cape Negruis, many of whose rocky peaks and platforms rise to an elevation of at least 5,000 feet. When, further, it is borne in mind that the coffee, a plant nearly allied to the cinchona, is apparently indigenous to a portion of the latter range; that, as shown by Dr. Falconer two trees, very nearly allied to the true barks, the *Hymenodictyon excelsum* and the *Lucalia gratissima*, are native in India, the latter growing abundantly in Sylhet, at the foot of the Kasia Hills. And also when it

Wild coffee grows abundantly in the Chittagong Hills; this fact was noticed by Sir W. Jones not many years after the establishment of the English Factory there. It may have been introduced by the Portuguese, but we have no evidence of the fact. It is, however, sufficiently evident that the shrub is capable of reaching its highest perfection in that soil. The cultivated coffee of Chittagong is, we believe, of excellent quality.

is recollected that the rocky nature of the soils and the hygrometric condition of the atmosphere in many of those situations appear very closely to approach those of the tracts in which the cinchonaceæ thrive best, it can scarcely be doubted that the experiment under consideration might be tried again with every prospect of success.

14. We would especially beg leave to insist upon the fact that when introduced into this country the plants were kept in Bengal during the hot season, and the rains, and that although doubtless carefully tended at Darjeeling, they do not appear to have remained under the care of a professed botanist, at that

Note.—Dr. Falconer, in his remarks upon the climates in which the cinchonaceæ thrive, observe, that "the same species of cinchona is said to be so much affected by situation and increase of temperature, as to alter the habit of the tree, and produce an entirely different quality of bark; low and hot valleys deteriorating its virtues so greatly, that it is rejected by the merchants as unfit for commerce."

place, where, weakened by cutting and by previous detention in a hot and close climate, in which all plants of their species must necessarily deteriorate, they were almost inevitably destroyed by the cold.

15. The steps which we would now venture to suggest for adoption by the Government, are the following:—

1st. That the experiment of introducing the cinchonaceæ into India should be tried upon an extensive scale, with several species of the plant, and in many parts of the country, but especially in the Neilgherries, in the range to the east of Sylhet, Chittagong, and the Tenasserim Provinces, and in various localities around Darjeeling.

That an establishment under the orders of a person properly qualified be deputed to collect cinchona plants of the best species (the seeds appearing to be too delicate to survive the voyage), and to despatch them in Ward's cases, duly tended; not as was done in the first experiment *via* Europe and the overland route, but as was originally recommended by Dr. Falconer, from Trinidad or Demerara direct to Calcutta and Madras, care being taken that they should not arrive in India later than the month of November.

2nd. That officers possessing the requisite botanical and geological knowledge should be deputed to inquire into those sites in the above localities which appear to be best calculated to receive the plants. That these officers being liberally furnished with the necessary aid and appliances, should receive the plants upon their arrival in India, and convey them forthwith to the spots prepared for their reception.

That considerable rewards should be offered to the native gardeners employed under these officers, with a view to encourage them to attend to the plants with the necessary assiduity.

16. At the present stage of this inquiry, it is almost needless that we should insist upon the advantages which would result from the success of such an experiment. The fact that in the five years 1849-53, nearly 54,000 *l.* were expended by the Honourable East India Company upon quinine and cinchona bark in the three Presidencies of India is, we would urge, of far less imperative import than the well-established certainty that the failure, and possibly the extinction of the South America cinchona supply is actually threatened, and that India is the only other country in the world which appears to afford a fitting habitat for the cinchonaceæ.

We have, &c.

(signed) *G. G. Spilsbury*, Physician General.
C. Renny, Surgeon General.
J. B. Clapperton, Inspector General.

(True copy.)

(signed) *Norman Chevers*,
 Secretary Medical Board.

— No. 16. —

REPORT by Dr. *Royle* on the Introduction into India of the Quinine-yielding Cinchonas, and of the means which have hitherto been adopted for the purpose.

East India House, March 1857.

THE almost inappreciable value of the cinchona, commonly called Peruvian bark, especially since the separation from them of the health and strength-restoring quinine and other alkalis is universally acknowledged. Hence it becomes a duty to humanity, not only to keep up but even to increase the supply of the cinchona trees which yield such valuable barks. The great difficulty is to find a suitable climate in a mountainous region for their healthy growth. Two Governors General, and the Government of Bengal, and the Medical Board on two occasions, the Agri-horticultural Society, and several medical officers, have recommended the introduction of cinchonas into suitable situations in India. Successive superintendents of the Honourable Company's Botanic Gardens in India have been of opinion that there is every probability of their successful cultivation in the Eastern Himalayas, that is, in the mountainous regions about Assam, and to the eastward of Silhet, also on the sides of the Neilgherries; probably also in parts of the Malabar coast.

I was myself, I believe, the first person to recommend the introduction of the true cinchona into India, and this, as long since as the year 1835, in my work on Himalayan botany. Thus, when treating of the family of plants to which the cinchonas belong, I inferred, from a comparison of the soil and climate with the geographical distribution of cinchonaceous plants, that the quinine-yielding cinchonas might be cultivated on the slopes of the Neilgherries and of the Southern Himalayas, in the same way that I had inferred that the China tea plant might be successfully cultivated in the Northern Himalayas.

Again, in the year 1847, when Mr. Blackwood, of Lima, offered through the Foreign Office to introduce the true cochineal insect and plant into India, I recommended that he should at the same time endeavour to introduce some of the cinchonas. This year he has again offered to introduce the cochineal insect into India, and has given some information about the cinchonas, but much more is known about them than Mr. B. seems to be aware of.

In the year 1852, Dr. Falconer, superintendent of the Honourable Company's Botanic Garden at Calcutta, wrote a paper which was read before the Agri-horticultural Society of Calcutta, and which was subsequently brought by them to the notice of the Most Noble the Governor of Bengal. In that paper Dr. Falconer strongly advocated the introduction of the cinchonas, and stated: "Dr. Royle has entertained the subject already, and I entirely concur in the opinion expressed by him, that the best situations for a trial are presented by the Khasya Hills, the mountains behind Chittagong and hilly parts of Upper Assam. The experiment, he continues, might also be extended to the hilly tracts around Darjeeling. The Neilgherries and the higher elevations of the Western Ghats appear to offer the most promising situations for Southern India. From the difficulties of the undertaking, and the little success that had attended the various endeavours to introduce cinchona plants into Europe, he recommended that an intelligent and qualified gardening collector should be deputed for a couple of years to the mountains of South America, for the purpose of exploring the cinchona forests, and for procuring an ample stock of young plants and seeds of all the best species.

When these papers were referred to me, as I coincided in opinion, and thought the measure proposed the best that could be devised, I recommended that it should be adopted, but with a slight variation. This, because the Bolivian Government, within whose territories had been found the best kind of cinchona, or that called Calisaya, had, as I explained, displayed considerable disinclination to the extension of the commerce of bark, except at greatly enhanced prices. I therefore thought that the gardening collector, deputed for the collection of cinchona plants and seeds, should also and ostensibly be employed in collecting other plants and seeds for the Horticultural or any other society, and thus divert attention from what would be his principal object; also that he should extend his investigation from 10° N. to 20° of S. latitude, as useful and quinine-yielding cinchonas are found about Santa Fé de Bagota, pale, and probably other barks in the mountains near Loxa, with one of the red barks from the mountains near Lima, and the best yellow or Calisaya bark from Bolivia.

As the proposal for sending a gardening collector was not approved of, and it was suggested that endeavours should be made to obtain seeds and plants of the several useful cinchonas by means of Her Majesty's Consuls, in the countries where these are known to grow, I therefore drew up detailed instructions on the subject, as it was hopeless to obtain any useful results, unless the directions to each Consul were of a specific nature. I therefore pointed out the plants to which Her Majesty's Consuls in New Granada, Equador, Peru, and Bolivia, should respectively attend; exports taking place from the ports of Carthagena, Guayaquil, Payta, Lima, and Arica. Having corrected the nomenclature of the species, according to the most recent investigation, as of Dr. Weddell, in Paris, and of Mr. Howard in this country, and pointed out the exact localities in the several Consulates, where such particular species was found, I added the English and the provincial names of the several barks which they produced, and by which they were known in commerce.

As I was at that time engaged in publishing the second edition of my Manual of Materia Medica, I had copies of the sheets referring to the cinchona barks struck off, and sent copies for each of the consuls.

Though not in the regular course of events it will probably be preferable to relate

relate in this place the results of these applications, though I have already done so in a great measure in my report, dated 3d January 1854.

Mr. E. Marks, who had been acting British Consul General at Santa Fé de Bagota, and who had been obliged to visit this country on account of his health, endeavoured to bring with him plants of two distinct species of cinchona (probably *C. Lancifolia*, and *C. Cordifolia*), which were obtainable in that neighbourhood. He wrote that he had had the plants for two months in his house at Bagota, and had considerable trouble in trying to bring them down the mountains, and along the Magdalena River, and on board of the steamers. He also wrote, "I believe that unless some experienced gardener, or botanical collector, be sent out to the countries producing the bark, there is but very little chance of getting any live plants from those countries."

Mr. Cope, Her Majesty's Consul in the State of Equator, wrote on the 31st October 1853, that he had transmitted to the Earl of Clarendon a box, containing plants of the yellow cinchona bark of Cuenca, and also plants, flowers, and seeds of the grey cinchona bark of Loxa (*C. Condaminea*). The plants and seeds had unfortunately been packed up in damp moss, which though it might possibly have been useful to the former, was the worst kind of packing for the latter. I sent the box and its contents to the gardens of the Horticultural Society on the 23d January 1854, and was sorry to observe that the plants seemed dead, and the seeds so damp, that there was little hope of their being alive. Mr. Gordon, the head gardener, in the Society's Gardens, reported that "the seeds were unripe when gathered, and dead when received, the seedlings sent along with the seeds were dead, being quite dried up and very badly packed; no skill could restore them."

Mr. Sullivan, Her Majesty's Chargé d'Affaires in Peru, wrote from Lima, that having no means there of procuring seeds of cinchona plants, he had addressed himself to Mr. Crompton, Her Majesty's Vice-Consul at Islay and Arica.

Mr. Crompton wrote from Islay, 18th October 1853, that having proceeded to Arequipa, he there found that "it would be impossible from the jealousy of these people to accomplish a successful result, if they conceived the British to be interested," except through the bark collectors employed in the interior, by the house of Gibbs & Co. He further wrote, that Mr. Stubbs, managing partner of that house, had agreed to send a person into the Montana to endeavour to get some seeds, but none have yet been received.

In reference to these experiments, it may be observed, that judging from the experience of all others, who have hitherto attempted to get rare seeds and plants by the same agency, as much was done as could have been expected, though the result has been nil.

But preceding these events, I was enabled to institute a small experiment with living cinchona plants, which I had hoped would have had a successful issue. Knowing that Dr. Weddell, who has explored the southern cinchona regions, discovered the calisaya, or that species which yields the best yellow bark, and that he had brought home seeds of this valuable species, which had germinated and produced young plants, both in France and in this country, I applied to, and obtained from the Botanic Gardens of Kew and Edinburgh, as well as from the Horticultural Society six plants of the true cinchona calisaya. As Mr. Fortune was at that time proceeding by the overland route on his mission to China to obtain tea seeds and plants as well as manufactures, he was requested to take charge of these plants, which he himself packed into a small Ward's case. These were conveyed by him along with the passengers of the mail of January 1854 across the desert, and five of the plants safely reached the Calcutta Botanic Garden, which was then under the superintendence of Dr. Falconer. Dr. Falconer, in his report dated 9th April 1855, states that the plants were retained in the Botanic Garden, throughout the hot weather and rains, in conservatory cases with the object of propagating from them. "It was however discovered there, as in the Horticultural Society's Garden here, that the plants bear pruning or cutting of any kind very ill, and were therefore no doubt injured by it. 'The buds,' Dr. F. continues, 'survived for a very long time, but never struck root, and finally perished. The original plants did not thrive well in the Botanic Gardens,' they were sent to Darjeeling where three of them arrived alive." Dr. Campbell reported from that place on the 30th September 1855, "that all the plants were killed by the cold of

last winter." He therefore recommends that in every future trial, "the plants should not be taken to a higher elevation than 2,000 feet." But the eligibility of a situation depends in a great measure upon the degree of warmth and moisture of climate, as well as in protection from other trees; and no doubt something also upon the soil.

About the same time that these plants were sent to India, I obtained through Mr. Pentland some of the calisaya seed which Dr. Weddell had collected either in his first journey or in some subsequent occasion, but which I know he had had for some time in his possession. These seeds I sent to Dr. Falconer, by whom they were sown in the Botanical Garden of Calcutta, but he wrote that "although watched with the utmost care by the European head gardener, none of them showed the slightest disposition to germinate." From this it has been inferred in the present correspondence that it is useless to obtain seeds of these cinchonas, and that reliance should be placed on plants only. These are no doubt the most important, and should be obtained; but it is a very erroneous inference to come to (from seeds of which nothing could have been known), that the seeds of the cinchonas are of no value. For the plants of *C. Calisaya*, which were at one time very numerous in hothouses in Europe, were all obtained from seeds brought home, by Dr. Weddell. What is required, is that the seeds should be collected by a competent person when ripe, then carefully dried and sent off in small parcels by successive mails. Some should be sown on arrival in the West Indies, others in hothouses in this country, and the remainder sent on to India. The great advantage would be that as they vegetated, a forest of cinchonas might be raised from them in a comparatively short time.

Moreover, as I have already referred in my letter of the 29th March 1856, to the efforts of the Dutch Government to introduce cinchona plants into the mountains of Java, it may be mentioned, as quoted from the Pharmaceutical Journal, for 1 April 1856, "A qualified careful person was sent to Peru, in order to import thence into Java, by way of the Pacific Ocean, a whole ship-load of plants and seeds. M. Hasskarl was charged with the expedition, and before one year had elapsed arrived safely with his cargo in Java, where he found the seeds sent out by him *via* Holland already in luxuriant growth."

Again, on the receipt of the despatch from the Government, dated 2d June, 1855, respecting the unsuccessful result of the experiment made in the year 1854, for the introduction of the quinine yielding cinchona plants into India, I recommended that a small sum should be expended in employing Dr. Jamieson, who is resident at Quito, in obtaining seeds of some valuable species, which are to be met with in the neighbourhood of Quito and Loxa. A sum of 50 *l.* was in consequence authorised for this purpose, with a promise of a further sum in case of success. I have not yet obtained any seeds from Dr. Jamieson, nor, indeed, have I heard from him in reply, but as the seeds are ripe in April and May, it is probable that some will shortly be sent, as he has written to the council of the Horticultural Society, who wrote to him for a more general supply, that he was going to send seeds to this country. I have no doubt, therefore, that I shall soon receive some, as Dr. J. is in the habit of supplying others with seeds and dried plants.

In addition to this source, I hope to obtain seeds of some of the useful species of cinchona through other channels, that is, through some of the large consumers of bark; of these, Mr. Howard, who is the largest manufacturer of quinine in this country, and the person who is probably better acquainted than any one else with all the different kinds of bark known in European commerce, has entered warmly into the project, and has written to his managing agent in South America to obtain seeds of the best kinds in his neighbourhood. Another consumer of bark has engaged, though not directly with me, to use his best efforts in obtaining seeds of the species common in the district where his agents are employed. In both cases as in that of Dr. Jamieson, I have offered to pay the expenses that are incurred in obtaining such seeds, which will probably not amount to any large sum.

The foregoing arrangements for obtaining seeds of the quinine yielding cinchonas, all depend upon the exertions of agents who may or may not second the proposals of their principals, and with all it must occupy a very subordinate place. Besides that they themselves would have to employ other agents to collect

collect the seeds, as they seldom if ever proceed into the bark forests. We cannot, therefore, rely upon getting any large quantities of good seed, though I consider it probable that we shall obtain some. The subject is yet of such great importance, both in an economical and philanthropic point of view, that every exertion should be made to ensure its accomplishment. I, therefore, consider that it is essential to employ a special agent or gardening collector as recommended by the Government of India; and I think that his ostensible object should be, that of making a general collection either for the gardens of India or of this country, while his special directions should be to keep as much as possible in the vicinity of the mountain tracts, along which the valuable cinchonas are known to grow. For instance, he might take what is comparatively an easy course, that is, by the steamer up the Magdalena, and first collect seeds and plants of the cinchonas near St. Fé de Bagota, and then proceed back or across to Payta, Quito, and the neighbourhood of Loxa, near all which several valuable kinds of cinchona are produced. The greater the number of species obtained, as well as the greater the extent of country over which the seeds are collected, the greater is the probability of success in finding soils and climates in the mountainous regions of India for the successful culture of some at least, if not of all, the species of useful cinchonas. The most valuable species of all, that is the cinchona calisaya, is unfortunately not only the most inaccessible, but also that which appears to have a more limited range of distribution, and to require a more peculiar climate. The attempts to obtain it by the special agent might be deferred to the second season, as there would be ample occupation for any one in obtaining seeds and plants of the other useful species in the first season. I do not more particularly refer to all these, or the localities where they are to be found, as they are detailed in the memorandum which I drew up for the use of the several consuls; but further instructions will require to be prepared in case of a special agent being appointed.

The kind of person best suited to accomplish successfully the object in view, is a gardening collector, that is, a gardener who has been sufficiently accustomed to plants to be able to distinguish those he is in search of, and who has also had sufficient experience in the collecting and drying of seeds, as well as in the transplanting of young plants, as to insure their safe carriage; say, in the first instance, to the Government Botanic Garden in the West Indies, until he himself could bring the last supplies to this country, or if thought desirable, take them to India and see them planted in the very mountains where they are to grow. Such a person, and well qualified for the purpose, may be obtained for 200*l.* or 250*l.* a year, and the travelling and other expenses would probably require as much more; the total of the whole being only about a fourth of the sum now spent yearly in the purchase of quinine by the Indian Government; but the quantity of which, as well as of the other cinchona alkalis, might very beneficially be increased in consumption, as nothing is so safe and has so powerful a control over all Indian fevers. If, on the other hand, we contemplate the possibility, nay probability of diminishing supplies of cinchona bark, when the more remote forests have been cleared, as the easily accessible forests have already been, every feeling of policy as well as of humanity prompts the adoption of measures, which may extend the basis of supply of one of the most valuable, indeed indispensable, means of cure for a vast number, not only of dangerous cases of otherwise fatal fevers, but also of still more numerous cases of the most painful neuralgic affections.

J. Forbes Royle, M. D.

— No. 17. —

EXTRACT DESPATCH from the Court of Directors to the Government of India; dated 3 March (No. 35), 1858.

Para. 41. WE did not fail to take immediate measures for carrying out the recommendations of your Government on this important subject. We regret, however, that these measures have not yet been attended with the desired success. We hope that we may

Letter from India, 10 November (No. 131) 1856.

Letter from India, 15 December (No. 142) 1856.

be able, at no distant period, to obtain a collection of both plants and seeds of the quinine-yielding cinchonas; and we will give you early intimation of the same, in order that the necessary preparation may be given for disposing of them to the best advantage on their arrival in India.

— No. 18. —

From Sir *J. Emerson Tennent* to *J. C. Melville*, Esq.

Sir,

Office of Committee of Privy Council for Trade,
Whitehall, 27 October 1858.

UNDERSTANDING that some years ago an experiment was made by the East India Company to introduce the cultivation of cinchona (Peruvian bark), into their territories, the Lords of the Committee of Privy Council for Trade direct me to request that you will convey to the Secretary of State for India their desire to be furnished with any documents illustrative of the nature of the attempt, the districts in which the experiment was instituted, the degree of success which attended it, and the nature of the causes (if any) which proved unfavourable. My Lords would be glad to know the opinion formed as to its ultimate practicability, and to be furnished with particulars of soil, climate, and temperature which seem to be most suitable.

I have, &c.

(signed) *J. Emerson Tennent*.

— No. 19. —

From Sir *George Clerk* to Sir *J. Emerson Tennent*.

Sir,

East India House, 2 December 1858.

IN reply to your letter of the 27th October, relative to the experiments made by the East India Company on the cultivation of cinchona (Peruvian bark) in India, I am desired by the Secretary of State for India in Council to transmit, for the information of the Lords of the Committee of Privy Council for Trade, a copy of the documents noted in the margin,* showing the measures taken for obtaining seeds and plants of the quinine-yielding cinchonas from South America, and the failure of the attempt to procure the growth and germination in India of the few plants and seeds which it has as yet been found practicable to obtain.

On a consideration of Dr. Forbes Royle's memorandum, in April 1857, the Court of Directors authorised that officer to despatch a botanical collector to the cinchona districts in South America, with such instructions as he might deem most applicable to the occasion, for the purpose of collecting plants and seeds of the quinine-yielding cinchona. Dr. Royle is understood to have taken steps to find an eligible person for this duty, but his death prevented the necessary arrangements from being completed. A successor has just been appointed to Dr. Royle's post, who will be directed to carry out the instructions above alluded to without any further delay.

I have, &c.

(signed) *G. Clerk*.

* Letter from T. Thomson, esq., Superintendent Botanic Garden, dated 14 May 1855.

Letter from H. Falconer, esq., M. D., dated 9 April 1855.

Letter from A. Campbell, esq., M. D., dated 30 April 1855.

Letter from Dr. J. F. Royle, M. D., dated East India House, March 1857.

Memorandum by Dr. Royle, regarding the introduction into India of the quinine-yielding cinchonas, dated March 1857.

— No. 20. —

From Mr. *Clements Markham* to Sir *George Clerk*, K. C. B.

Sir,

India Office, 5 April 1859.

UNDERSTANDING that it is the intention of the Secretary of State to take measures for the introduction of the cinchona plant into India, on a large scale, I venture to offer my services for that purpose.

It will be well, in the first place, to recapitulate the arguments proving the urgent necessity of the measure, and the best means for effecting it; and secondly, the qualifications which I possess in order to bring it to a successful conclusion.

"Among the vast variety of medical drugs," says Dr. Royle in 1852, "there is not one, with probably the single exception of opium, which is more valuable to man than quinine-yielding cinchona." In 1853 he says, "The successful introduction into India of the cinchona will be of great benefit not only to that country, but to the world in general, as there is great fear that the supply from the original sources may become so much diminished as to be beyond the reach of the mass of those who require the aid of quinine. To the Indian Government a home supply of a drug which already costs about 7,000 *l.* a year, would be advantageous in an economical point of view, and invaluable as affording means of employing a drug which is indispensable in the treatment of Indian fevers."

"The probability of entire success in the cultivation of the cinchona trees in India seems to admit of hardly any doubt, if ordinary care is adopted in the selection of suitable localities on the slopes of the Neilgherries, and the Southern Himalayas."

It has been proved, by fruitless experiments, that it is useless to attempt to procure either the plants or the seeds, through the instrumentality of Her Majesty's consuls; or through agents, having no interest in the success of their labours, and who probably employ other agents to deal with the actual *cascarillero* or collector.

Great care and attention are necessary in collecting seeds or plants, the latter especially. The seeds must be ripe when gathered, they must then be dried in the sun, and kept dry, as well as occasionally exposed to the air. Much personal attention is necessary, to ensure the seeds being gathered from the right trees. Plants require still more care. Considerable tact also is required in order to avoid exciting jealousy in the minds of Government officials.

These facts are pointed out, in order to show how fruitless it will be to trust to agents and consuls, and how necessary it is to employ some person whose heart is really in the business.

I now venture to refer to the qualifications which I possess for this service.

I am well acquainted with several of the forests in Peru, and on the frontiers of Bolivia, containing the cinchona tree. I already know three of the more useful species by sight, and should be able to acquire a thorough knowledge of the others before leaving England. I know not only the Spanish language, but also the Quichua, or language spoken by the Indians of those districts; and I am intimate with many of the public men, and the landowners on the eastern slopes of the Cordillera. I trust I may add that I am most anxious to perform this service well, which I feel to be of such great importance.

I have, &c.

Sir George Clerk,
&c., &c., &c.

(signed) *Clements R. Markham.*

— No. 21. —

RESOLUTION of the Revenue, Judicial, and Legislative Committee approved by the Secretary of State for India in Council, 8 April 1859.

THE Committee have had under their consideration a letter from Mr. J. Gerstenberg, "Chairman of the Ecuador Land Company (Limited)," dated 29th ultimo, respecting the measures proposed to be taken by the Company for developing

developing the resources of the territory made over by the State of Ecuador for the benefit of its British creditors, and submitting a proposal that the Indian Government should take part in a scientific mission, which it is proposed to attach to the commercial enterprise, and in which it is designed that the French Government should also take part, the special object proposed in the arrangement being the collection of seeds and plants of the quinine-yielding cinchonas for despatch, on the one hand to Algeria, and on the other to the East Indies.

The Committee, bearing in mind the extreme importance of quinine as a medical agent in India, and the expense to which the Government has annually been put in procuring a supply, and which expense must, under present circumstances, be largely increased, have given their careful consideration to the proposal before them. But in the first case they find that there is no evidence that the most valuable species of the cinchona are to be found in the territory granted by the Ecuador Government, and further, they are of opinion that a mission conducted by a commercial association, whose principal object must be to develop resources which will prove a permanent source of income, is not the most likely means of attaining the object to be aimed at, the full success of which would in effect render India independent, as regards the supply of quinine, of those provinces of South America, where the more valuable cinchona trees abound. The Committee are therefore unable to recommend to the Secretary of State the acceptance of the proposals contained in the letter of Mr. Gerstenberg.

The Committee, however, have had under their consideration a plan for obtaining the requisite supply of seeds and plants of the cinchona, which is in accordance with the measures formerly approved by the Court of Directors, and which appears to them well fitted to attain the object.

On the failure of the attempt made to provide a supply of plants and seeds through the instrumentality of Her Majesty's Consuls in the South American States, where the quinine-yielding cinchonas are known to exist, the court sanctioned a proposal for the deputation of a special agent for the purpose, and the late Dr. Forbes Royle was engaged for two or three years before his death in seeking for a properly qualified collector to undertake the duty. He did not succeed in his attempt; and, though the subject has since, with special reference to a renewed representation from the Government of India on the subject, been under reference to Dr. Forbes Watson, the present reporter on the products of India, no fit person has hitherto been met with.

A proposal to undertake the mission, which seems to the Committee to be well worthy of acceptance, has now been made to them by Mr. Clements Markham, a clerk in the department of India correspondence. The letter of Mr. Markham offering his services in this behalf, is submitted for the information of the Secretary of State in Council, and from that it will be seen that his qualifications for the duty consist of a knowledge of the best cinchona districts, acquired during a residence in Peru and Bolivia; a general knowledge of various species of the cinchona tree; an acquaintance with the Spanish language and with the Quichua or language of the Indians of the districts in question, and an intimacy with many of the public men and landowners on the eastern slopes of the Cordilleras where the cinchonas abound.

It appears to the Committee that having regard to the urgent importance in both a medical and an economical point of view, of introducing the plant into India without further loss of time, and to the failure of the attempts hitherto made to procure the services of a suitable collector, it is advisable to take advantage of the offer of Mr. Markham, and to entrust to him the proposed commission.

It will probably not be necessary for Mr. Markham to start much before the close of the present year, in order to procure the first available supply of seeds and young plants; and he will, therefore, have ample time to make himself more thoroughly acquainted with the varieties of the cinchona plants which he is especially to seek for, and with all the details with regard to the packing and despatch of his collections, the knowledge of which may be requisite to the satisfactory performance of the duty he proposes to undertake.

It will be observed that Mr. Markham does not ask for more than his present salary, and the payment of all his expenses; but if the Secretary of State in Council should give his general assent to the proposal, the Committee would suggest that they may be empowered, subject to his Lordship's final approval,

to

to settle all necessary details with Mr. Markham, both as regards the terms on which he would proceed on his mission, and the arrangements for his journey, and for the collection and despatch to India of the seeds and plants which he may collect.

It will of course be necessary, if Mr. Markham is deputed on this service, that some arrangement should be made for the temporary discharge of his duties in the Revenue Department to which he is attached.

— No. 22. —

(No. 59.)

From Lord *Stanley* to the Governor General of India.

My Lord,

India Office, London, 9 June 1859.

HAVING again taken into consideration the subject of introducing seeds and plants of the quinine-yielding cinchona into India, I have resolved, in Council, to depute a confidential officer to South America during the ensuing season, to make a collection of the seeds and plants, and to convey them to Calcutta, Madras, and Ceylon.

2. I therefore have to request that you will call upon the superintendent of the Botanical Gardens at Calcutta, to furnish you with his opinion respecting the best locality for planting the cinchona in your Presidency, and with any other observations which he may deem useful, respecting the cultivation of those plants in India.

I have, &c.
(signed) *Stanley.*

— No. 23. —

From the Government of India to the Right Honourable Sir *Charles Wood*,
Bart., G.C.B., Secretary of State for India.

Sir,

Fort William, 9 January 1860.

IN continuation of our Despatch No. 102 of 1859, dated the 24th of September, we have the honour to forward to you copies of the reports that we have procured, in pursuance of the Despatches noted on the margin, from the Agricultural and Horticultural Society; from Dr. Thomson, the Superintendent of the Calcutta Botanical Gardens; and from Dr. Jamieson, the Superintendent of the Botanical Gardens in the North-Western Provinces, regarding the measures to be taken preparatory to the arrival of the cinchonas in India, and the localities to be selected in this Presidency for their cultivation.

No. 59 of 1859,
dated 9 June.
No. 99 of 1859,
dated 7 October.

2. We have, however, since received your Despatch No. 119, dated the 24th November, 1859, and its enclosure, from which we learn that the experiment is to be confined, in the first instance, to the Neilgherry Hills, in the Madras Presidency, and that it is not therefore necessary that we should take, at present, any further steps in this Presidency, in accordance with the previous Despatches of the 9th June and 7th October, 1859. A communication to this effect has been made to his Excellency the Governor General, and to the Governments of Bengal, the North-Western Provinces, and Bombay.

3. We forward an interesting memorandum, furnished to us by Dr. Brandis, the Superintendent of Forests in Pegu and Tenasserim, on the suitability of the mountain tracts of those provinces for the cultivation of the quinine-yielding cinchonas.

We have, &c.,

(signed)

J. Outram,
H. B. E. Frere.

Enclosure 1, in No 23.

From *A. H. Blechynden*, Esq., Secretary, Agricultural and Horticultural Society, to *W. Grey*, Esq., Secretary to the Government of India, dated Calcutta, the 24th August 1859.

I AM directed by the Agricultural and Horticultural Society to acknowledge the receipt of your letter of the 23rd ultimo, intimating that Her Majesty's Government have determined on deputing a confidential officer to South America, to make a collection of seeds and plants of quinine-yielding cinchonas, and conveying them to Calcutta, Madras, and Ceylon, and requesting information from the society as to the best locality for planting the trees in this Presidency, with any other observations that they may deem useful respecting the cultivation of those species of cinchonas in India.

2. In reply I am directed to state that the requisites for the successful cultivation of these valuable plants appear to be a moist and equally temperate climate. Frost and snow, and dry heat are to be avoided. For this reason, the localities in this Presidency best adapted for attempting their culture, appear to be those already enumerated in the fourth paragraph of my letter of the 28th August 1856, namely, the Hills near Darjeeling or say Sikkim, the Khasyah Hills, the mountains beyond Chittagong, the hilly parts of Upper Assam, the Tenasserim Provinces; and, in Southern India, the Neilgherries and the high elevation of the Western Ghats.

3. The society, I am directed to observe, are scarcely in a position to offer any practical observations in regard to the second point adverted to in your letter under acknowledgment. They would, however, venture to submit the few following remarks, which, if acted on, may, they conceive, lead to the successful introduction and cultivation of the plant in India:—

First. It would be very desirable so to time the despatch of the plants and seeds from their native country as to reach India at the commencement of the cold season. The recommendations contained in Dr. Falconer's paper (Journal of the Agricultural and Horticultural Society, vol. VIII., p. 16) in respect to the mode of despatch of seeds and plant are, the society think, well worthy of adoption.

Second. It would be further desirable, the society conceive, to act on the suggestions of the late Mr. Piddington, as detailed in his memorandum, published in the Society's Journal (vol. X., p. 140), more especially those parts which relate to soil and climate, as enumerated under Sections A. to D. of the memorandum in question.

Third. The proposal in the Minute of the Right Honourable the Governor General (vol. X., page 144), namely, "that officers possessing the requisite botanical and geological knowledge should be deputed to inquire as to the sites best calculated to receive the plants; that these officers, duly supplied with all aids and appliances, should receive the plants upon arrival, and convey them to the selected spots," appear to the society also worthy of adoption, with the view of giving the interesting and important experiment a full and fair trial.

4. The best and most reliable information as respects the cultivation of these trees in their native climate is to be found, the society believe, in Weddell's "*Histoire Naturelle des Quinquinas*." This information, modified according to circumstances, will doubtless prove very useful to those officers who may hereafter be entrusted with the superintendence of cinchona plantations in various parts of India.

Enclosure 2, in No. 23.

From *Thomas Thomson*, Esq., M.D., Superintendent of Botanic Garden, Calcutta, to the Secretary to the Government of Bengal—(No. 193, dated the 6th September, 1859).

Sir,

I HAVE the honour to acknowledge the receipt of your letter of 2d August, calling for my opinion on the best locality for planting the cinchona, and for any other observations I may deem useful respecting the cultivation of that tree in India.

2. The various species of cinchona differ widely in physical qualities, and grow in very different climates; but the attention of the officer deputed to America will doubtless be specially directed to the best kinds, and in particular to *Cinchona Calisaya*, which is believed to yield the finest quality of bark. This species is a native of tropical South America, between 13 and 16 south latitude, at elevations of 5,000 and 6,000 feet. It delights in a very humid, temperate climate, in which there is but little variation of temperature throughout the year, so that the tree is never subject either to a powerful sun or to severe frost.

3. As regards the best locality for the cultivation of cinchona, I can add little to what has been stated by Royle, Falconer, and others. It is of course desirable that the places selected for the experiment should possess as nearly as possible the climate in which the plant is indigenous. As the cultivation must be directed by qualified officers, the number of spots selected cannot be numerous, but they should not, I think, be less than two.

4. If two be the number fixed on, one should be (as was long ago stated by Dr. Royle towards the southern extremity of the Madras peninsula, where the mountains afford the requisite elevation and humidity, in a latitude not very different from that in which the plant is indigenous. The selection of the exact spot must be left to local experience. Thence, after the cultivation is established, it may be extended to Ceylon, and perhaps to the Malayan peninsula.

5. The other site should, I think, be on the Khasia Hills, where the climate is very well suited to the growth of cinchona, notwithstanding a little difference of latitude, and where elevations of 5,000 to 6,000 feet are easily obtained.

6. Thence the cultivation will probably hereafter be extended to the Sikkim Himalaya, which is abundantly humid, but which from the occasional excess of winter cold, caused by the proximity of the snowy mountains, is on the whole less suited for a first experiment.

7. The cinchona plants and seeds will of course be forwarded by the most expeditious route from the west coast of South America. They should arrive in India early in December, and not sooner. This will give ample time for transport to a cool climate before the hot season.

8. As the successful conduct of the experiment will require great care, I consider that it is important to avoid everything which can possibly cause delay. It is, therefore, essential that the exact sites should be selected, the ground cleared, and every minor arrangement made before the plants arrive in India.

Enclosure 3, in No. 23.

From *W. Grey*, Esq., Secretary to the Government of India, to *T. Thomson*, Esq., M.D., Superintendent Botanical Garden, Calcutta—(No. 2,312, dated the 24th November, 1859).

WITH reference to your communication to the Bengal Government, No. 193, dated 6th September, I am directed to forward to you a copy of a pamphlet drawn up by Mr. Markham, the gentleman who has been employed by the Home Government to proceed to South America for the purpose of procuring cinchona plants and seeds, and to request that you will be good enough to submit any further suggestions regarding the best locality for the cinchonas, as well as regarding any other practical points connected with the experiment about to be made, which may occur to you from a perusal of Mr. Markham's pamphlet.

2. The seeds and plants which will be received in Calcutta are intended to be disposed of in Bengal and its dependencies. Separate consignments are to be made to Madras and Ceylon.

Enclosure 4, in No. 23.

From *W. Jameson*, Esq., Superintendent Botanical Gardens, North Western Provinces, to *F. B. Outram*, Esq., Officiating under Secretary to the Government of the North Western Provinces, No. 439, dated Camp Kowlaglier, Dehra Dhoon, the 11th September 1859.

I HAVE the honour to acknowledge the receipt of your letter No. 1416, dated 7th ultimo, enclosing two letters regarding the cultivation of the cinchona plant in India, and calling for a report on the best localities for cultivating it in North-West Provinces.

2. The number of species of cinchona known amounts to upwards of 20, which are found occupying a belt extending over nearly 30 degrees of latitude, or from 10 degrees north to 20 degrees south.

3. The true cinchonas are chiefly confined to the Andes of Peru, Columbia and Bolivia, and occur at altitudes varying from 1,200 to 10,000 feet above the level of the sea. They are thus met with in different kinds of climates, varying from tropical to temperate, which abound in the Himalayas in Kumaon, and Gurhwal and Kohistan, of the Punjab.

4. By most travellers who have visited the districts where the cinchona plants are found, the rock formations are described as belonging to the primary series, consisting of mica and clay slates, gniess, granite, &c.

5. Some species of cinchona grow in dense forests in warm valleys, ranging from 1,200 to 2,000 feet in altitude. Others are met with on the declivities of mountains, and at altitudes varying from 6,000 to 10,000 feet, or the former in a tropical, and the latter in temperate climates. To meet these extremes, it will therefore be necessary to select several localities.

6. For the species met with in hot valleys, I would recommend Chegouri at the southern base of the Tyne Range in Western Gurhwal.

7. For the species met with in more temperate regions, and at higher altitudes, or from 4,000, to 6,000 feet, I would recommend Kote, on the northern side of the Tyne Range.

8. And for species formed in the highest altitudes, or from 7,000 to 10,000, I would recommend Danoulti, east of Landour.

9. All these localities are in primary districts, and similar in formation to the districts where the plants now occur, and from this we may infer, that the soil is of a similar nature, the primary rocks of the Andes being nearly identical with those of the Himalayas.

10. Until, however, the report of the officer deputed to collect the plants be submitted, stating the localities where the plants have been collected, it would be premature to assign localities at present, unless in a general manner, as has been done.

11. But the receiving officer in Calcutta ought to be careful not to mix the species, as the locality that suits one species may be quite unfitted for another.

12. The localities recommended by me are of easy access, and all situated in the late Teeree Rajah's country. I brought this to the notice of Major Ramsay, Commissioner, Kumaon, before the country was made over to the late Rajah's illegitimate son, and he stated that there would be no difficulty whatever in procuring from the rajah a grant of the lands on very easy terms.

13. There are other localities where the cinchona plants might be advantageously tried, as in the Cherra Poonjee and Neilgherie Hills. But as I have not visited them, and as the former have been examined by Dr. Thomson, of Calcutta, and to the latter the labours of Dr. Cleghorn, of Madras, extend, these gentlemen will be better prepared to give opinions as to the localities on these mountains to be selected for the purpose.

No. 1732, dated Allahabad, the 23rd September 1859.

Order.—Ordered that copy of the foregoing be forwarded to the Secretary to the Government of India, Home Department, in reply to No. 1499, dated the 23rd July last.

(signed) A. M. Monteith,
Offg. Asst. Sec., Govt., N. W. P.

Enclosure 5, in No. 23.

From T. Thomson, Esq., M.D., Superintendent Botanic Garden, Calcutta, to W. Grey, Esq., Secretary to the Government of India, No. 202, dated the 6th December 1859.

I HAVE the honour to acknowledge the receipt of your letter No. 2312, dated 24th ultimo, forwarding a copy of Mr. Markham's pamphlet on cinchonas, and calling on me to submit any further remarks on the subject, which its perusal may suggest.

2. The information contained in it confirms me in my opinion, that the cinchona will succeed well in the Khasya hills. No other place in the Bengal Presidency appears to me equally suitable for a first experiment. Suitable elevation and climate may perhaps be found in Tennasserim, but the interior of that province is too little known to make this certain.

3. The exact site should be selected by a practical botanist, after careful comparison of the vegetation and climate of the Khasya hills with that of the Cinchona forests, as described by Weddell and others.

4. The officer deputed for this purpose should pass the whole of next rainy season in the hills, so as to become familiar with the physical features and climate of the range. He should visit the most promising places repeatedly during the season, and make the final selection

selection about the beginning of November, before which time the active preparations for the reception of the plants need not be begun.

5. An intelligent English gardener should, I think, be engaged for the practical supervision of the cultivation, and especially for the raising of the seeds and preparation of cuttings, two very delicate operations, upon which the rapid extension of the plant will mainly depend. The gardener need not be here till the plants arrive, and if Mr. Markham is accompanied to South America by a gardener, he will probably be glad to remain. After a time, the services of the gardener will be required for the extension of the cultivation to new districts, which, after a year or two's residence in the country, he will be quite qualified to superintend.

6. A supply of bell glasses should be indented for from England, and kept in readiness here, to be forwarded with the plants to their destination.

Enclosure 6, in No. 23.

From Dr. *D. Brandis*, Superintendent of Forests, Pegu, Tenasserim and Martaban Provinces, to *W. Grey*, Esq., Secretary to the Government of India, dated Calcutta, the 29th December 1859.

IN compliance with your verbal request, I have now the honour to submit a memorandum of remarks concerning the localities suitable for the cultivation of the Peru bark tree in the Pegu, Tenasserim and Martaban Provinces. I have been obliged to enter into some detail regarding the general configuration of the country, as the ideas generally entertained, of the situation of the mountainous parts of those provinces are not very clear, and a partial description might have led to misunderstanding, and this has led me to add some notes on the establishment of a sanatorium there.

2. As I have not the means here of keeping copies, I would solicit the favour of your directing them to be sent to the Commissioner of Pegu. If such should appear unobjectionable, I should be glad to be permitted to publish the memorandum with additional notes, lists of plants, the detail of my meteorological observations, and extracts from my journals—in the Journal of the Asiatic Society or elsewhere.

Enclosure 7, in No. 23.

MEMORANDUM by Dr. *Brandis*, on the Prospects of an Experimental Cultivation of the Quinine-yielding Cinchonas on the Mountain Tracts of the Pegu, Tenasserim, and Martaban Provinces, with notes on the establishment of a Sanatorium there by Dr. *Brandis*, Superintendent of Forests, Pegu and Tenasserim.

The quinine-yielding cinchonas are found within the tropics of South America, in the vallies of the Andes, range at an elevation of from 3,000 to 6,000 feet, in the immediate neighbourhood of mountain masses, which rise up to 18,000 feet, and are partly covered with eternal snow.

Points to be observed in selecting localities for cinchona cultivation.

This indicates, in a general way, the requirements of the plant; but although in the first instance such places should be selected for the experiment as are particularly suitable, it must not be lost sight of, that the cultivation of the Peru bark tree may also succeed in localities not appearing to offer exactly the same conditions regarding climate and the general character of the country, which are peculiar to their native place.

There is no lack in India of situations apparently well suited for the experiment, and as several of them, viz. the Neilgherries, Darjeeling, and the Khasya Hills, offer particular facilities for making the trial; it would appear that at first a further extension of the projected cinchona plantations is not called for, unless indeed the mountains of the Pegu, Tenasserim, and Martaban Provinces should offer superior advantages. The following remarks will show that this is not the case, and that it appears preferable to delay the introduction of the tree into the eastern provinces, until its cultivation shall have proved successful in other parts, when it can be managed with greater facility.

Localities available in India.

Hereafter, when plants can be obtained from the older plantations, it may well be worth while to extend the cultivation of the tree, and indeed it is not impossible that some of the tracts described below, will be found to possess peculiar advantages for the production of the quinine-yielding bark.

To avoid misunderstanding, it appears necessary to review the general configuration of Pegu, the Tenasserim, and Martaban provinces.

General structure of the mountain masses of the provinces.

2. Four great mountain ranges, running more or less parallel to the sea coast, from north-west to south-east, form as it were the skeleton of these provinces. They separate from each other the valleys of the principal rivers of the country, and intervene between them and the coast. Geologically they are composed of rocks widely differing in character, but the strike of the strata, whenever there is stratification, and the direction of the main spurs and ridges, pursues, as far as is known, with due deviations, but upon the whole with remarkable regularity, a line running from 15° to 45° west of north.

Arracan Yomah.

Proceeding from west to east, the first range is the Arracan Yomah, which divides the province of Arracan from Pegu and Burmah Proper, not attaining within Pegu an elevation exceeding 4,000 feet; this range cannot be selected for the first cultivation of the Peru bark tree. Its northern part, which divides Arracan from the Burmese empire and Muni-poor, and which forms a connexion with the Khasya and other mountains east of Bengal, is said to be higher; but of this portion I cannot speak.

Pegu Yomah.

The second range is the Pegu Yomah, which separates the valley of the Irawaddee and Sitang rivers. Its highest point is the Kambalootoun, near the source of the Pegu river, nearly in the latitude of Akontoun on the Irawaddee, below Prome. The height of this hill has not been measured, but by comparing it with others in its immediate vicinity, I have estimated it at about 3,000 feet. The mean elevation of the range is not above 2,000 feet. Hence these hills also, which are the principal seat of the Pegu teak forests, are not suited for an experimental cultivation of the cinchonas.

Sitang range and Tenasserim coast range.

The third range consists of two parts, of which the northern may be designated the Sitang and Martaban range, the southern the Tenasserim coast range. It commences north-east of Toungoo, where it separates the tributaries of the Sitang river from the different branches of the Thonkyeghat, and further south from the Yoonzaleen river. North-east of Shoaegyeen it divides into two great branches, the western running down between the Sitang and Beeling rivers, the eastern between the Beeling and Salween. The eastern branch which maintains the general direction of the range, ceases near Martaban, but recommences immediately south of Moulmein, and thence skirts the coast of the Tenasserim Provinces down to Mergui, and beyond it.

Like all the others, this range is not one interrupted ridge, but a system of numerous longitudinal spurs, some shorter, others longer, and joined by transverse ridges, frequently lower than the longitudinal spurs.

Many parts of this range are entirely unexplored; but it does not appear to exceed a height of 5,000 feet, and this is not a sufficient elevation to warrant an attempt in the first instance.

Salween range.

3. The fourth or easternmost range is the only one which appears to offer sufficient inducement for an experimental cultivation of the Peru bark tree. It is the main out-runner or projection of the great Karenee and Shan plateau, which extends from the Salween to the Irawaddee valley. South of this plateau, this range forms the water-shed between the Sitang and Salween rivers.

Yoonzaleen mountain mass.

South-east of Toungoo it attains a considerable elevation, and at the same time extends into a large and compact mountain mass, separated from the third or Sitang range by a remarkable longitudinal valley, through which two rivers run in opposite directions, separated at their head waters only by a low and narrow saddle. These streams are the Myitgnam, a tributary of the Thonkyeghat, running from south to north, and the western branch of the Yoonzaleen from north to south. This mountain mass, which appears to me the fittest place, both for the establishment of a sanatorium and the experimental cultivation of cinchonas, is drained on the east and north-east of the Salween side, by the feeders of the Karenee Choung (Pounloun), the Kaymapjoo or Tin Choung, and the Pah Choung, fixed by Major Allan as the northern boundary of the Martaban Province. The drainage to the west and north-west goes into the Sitang river, principally through two great feeders of the Thonkyeghat, the Rjay Choung and Myitgnan Choung. To the south the drainage runs almost entirely into the two great branches of the Yoonzaleen, the Braillo or western, and the Llaillo or eastern branch. The different peaks and spurs of this mountain mass have numerous Karen names, but no designation has as yet been adopted for the whole of it. It may fitly be called the Yoonzaleen mountain mass, but for the entire range, of which it forms a part, I would propose the name of the Salween range for the northern portion, and Thoungyeen range for the southern part.

The highest points here visited by me were the Tapio Ridge, on the west side, one of the lower spurs between the Myitgnan and Rjay Choung, 5,850 feet high, and two passes on the road from the Kaymapjoo Choung to Toungoo, one on the north-east side, 5,000 feet, and one on the north-west side, 5,237 feet high. But numerous spurs of great extent, and considerably higher, were observed from these points, and by taking the angle of elevation, and estimating the distances, I came to the conclusion that numerous points seen by me could not be less than 7,000 feet high, and probably considerably above this.

Major Allan, in his report on the northern frontier of the Martaban Province, arrives, I believe, at a similar conclusion with regard to one of the southermost peaks of this mountain mass, the Tsotseeko, and Mr. O'Riley estimates another, the Nat-toung at 8,000 feet.

The highest spurs, which themselves cover a considerable space, are surrounded by masses of mountains with an average elevation of 4,000 feet; the area of the whole may be estimated at 100 square miles. Nearly the whole of this Yoonzaleen mountain mass is situated north

of

of the imaginary line laid down by Major Allan as the north boundary of the Martaban Province, and belongs, therefore, to the Toungoo division of the Province of Pegu, as far as it may be claimed by the British Government.

We now proceed to trace the further course of the Salween mountain range to the south.

In the latitude of Kolodo, 25 miles to the south of the north end of the mountain mass here described, the range begins to contract, and its elevation is considerably diminished. In crossing the range on the road from Kolodo to Shoaegyeen, the elevation of the water-shed is only 3,264 feet (Hottalo Sakan) and the mean elevation of the Yoonzaleen table-land, which skirts the south-west side of the mountain mass above described, is from 2,600 to 3,200 feet. South of Kolodo (1,973 feet elevation) the Salween range assumes the shape of a narrow range between the Yoonzaleen and Salween, falling off more gradually towards the latter river. From here down to the mouth of the Yoonzaleen, it is called the Bithoko range. As there are Teak localities on both flanks, I had to cross it at four different places, viz. :—

South of Kolodo at an elevation of	-	-	-	-	-	3,393 feet.
Near Papoon -	-	-	-	-	-	3,137 "
" Pagotivill -	-	-	-	-	-	3,967 "
" the great Salween rapids	-	-	-	-	-	3,910 "

It is clear that these elevations are not sufficiently high to admit of their being selected for the cultivation of cinchonas.

4. The Salween range ceases at the junction of the Salween and Yoonzaleen, but its continuation, the Thoungyeen range, commences in the fork formed by the latter river and the Salween, and, pursuing the same south-easterly direction, it extends along the Thoungyeen, separating the valley of this river from that of the Hlimbong and Houndrow. In this range two points of considerable elevation are known, the Mooleyit and the Daunat Pass. The former, which is near the Siamese boundary, is described by Major Tickell as an isolated peak, 7,171 feet high, and the latter was measured by me in April last, and found to be 5,474 feet. But as far as is yet known, the Thoungyeen range is much more irregular and broken than the Salween range, and has not any extent of mountain land to be compared to that north of the Yoonzaleen. From the height of the Daunat Pass a number of isolated peaks are seen, but few of them are higher than the Pass, and the difference in elevation does not appear to be considerable. There are several entire breaks in the Thoungyeen mountain range; the main road from Moulmein to Zimmay, in Siam, leads through one of these breaks (the Yimbine road.) This more irregular and less compact character of these mountains may be connected with the prevalence of limestone masses here, which in the Salween mountains are found on the outskirts only, and in the valleys of the neighbouring streams.

Thoungyeen range.

The country round the Mooleyit peak, which I have not visited myself, may possibly offer sites advantageous for cinchona cultivation, and in case the establishment of a sanatorium at that place should be decided upon, it would be comparatively easy to form an experimental cinchona plantation there; but for the present my remarks will be limited to the Yoonzaleen mountain mass, and I will now proceed to add a few remarks regarding the climate, rocks, vegetation, and inhabitants of those mountains, the extent and elevation of which has above been discussed.

5. No regular series of observations of temperature, humidity, and rainfall on these hills at an elevation exceeding 4,000 feet, is available. I had only two opportunities of visiting them, once in February 1859, when coming from Toungoo to the Salween Forests, and once in May of the same year, when returning from Toungoo. On both occasions I was obliged to hurry on, the observations therefore were taken only during a few days.

Further remarks regarding the Yoonzaleen mountain mass. Climate.

But the following facts seem to be established by the observations available, and the testimony of the natives :—

1st.—The rainfall is considerably greater than in the neighbouring plains, and the rains commence earlier and cease later.

2nd.—The temperature throughout the year is lower, and of a more uniform character. That is, although the daily changes are occasionally very great, the difference between the seasons is less considerable.

From the 13th to the 22nd February, the daily minimum about sunrise was found to vary from 42 to 69 degrees at elevations between 2,600 and 3,500 feet. The daily maximum varied between 82 and 85.5 degrees.

From the 16th to 19th May, at elevations of 3,100 and 4,300 feet, the thermometer ranged as follows: minimum from 66 degrees to 69.5 degrees, maximum from 74 to 76 degrees.

At an elevation of 5,850 feet, the thermometer stood at 67 degrees at noon of the 14th February, and at 5,237 feet, on the 19th May, at 2.45 P.M. it was 73.75 degrees.

The temperature of the two branches of the Yoonzaleen river, at the points where they the higher mountains was found:—

West branch, 17th February, at noon, 59 degrees, temperature of air 70 degrees.	
18th " at 9 A.M., 56 degrees,	" 60 degrees.

On the Yoonzaleen plateau, a wide extent of country south-west of the main mountain mass,

mass, from 2,600 to 3,200 feet high, frost is said to cover the ground nearly every morning in December and January, and this is given as the reason why the Betel palm will not thrive here, although it is cultivated to a great extent in the valleys round about.

Rocks.

6. The rocks observed on the mountains here described are granite, gneiss, and quartz. Limestone is only found much lower down in the valleys of the Salween, Sitang, and Yoonzaleen rivers and their tributaries. The tin washings near the head waters of the Kaymapjoo Choung are on the ridges of several of the outer spurs on the east side of these mountains, at an elevation of from 3,000 to 4,000 feet. They are worked by the Karen inhabitants of Kliilo village (3,107 feet elevation) who barter the tin to the Red Karens for cattle, which they do not keep, but slaughter for their own consumption.

Vegetation.

7. The vegetation has an entirely tropical character up to an elevation of 3,000 feet, when teak entirely disappears, and the pine forests begin. These pine forests (of *Pinus Khasyana Royle*) do not rise above 5,000 feet, and are always on dry, gravelly soil. With them occur several species of oak, vaccinium, gordonia, and *Rubus moluccanus* with *Clematis acuminata*. The higher spurs and the moist valleys and slopes within the pine region are covered with dense evergreen forest, except where it has been cleared away for the toungyas or hill clearings of the Karens, which do not occupy any considerable space above 4,000 feet elevation. Thus the entire surface of the higher mountains, with the exception perhaps of isolated peaks, is clothed with uninterrupted dense evergreen forest. The trees composing this forest are as yet little known; but the absence of many tropical forms, and the prevalence of species of quercus and castanea indicates an approach to the vegetation of a more temperate climate.

The cultivation of quinine-yielding cinchonas, if anywhere in these provinces, might be attempted here on ground rendered fertile by the undisturbed occupancy of these dense primeval forests, and kept moist by their retaining rain and dew, and collecting the atmospheric moisture. The dense vegetation which covers the highest spurs has also this advantageous effect, that even at considerable elevations there is an abundance of small mountain streams, with running water of low temperature throughout the year. This is an advantage which may possibly not be found in the same degree in many other localities available in British India for the cultivation of the Peruvian bark tree.

Inhabitants.

8. The whole of the mountains between the Sitang and Salween inhabited by various tribes of Sgan Karens, who cultivate paddy on their hill clearings or toungyas, the large bamboo round their villages, and the betel pepper, betel palms, and an indigo-yielding acanthaceous plant (*Goldfussia sp.*) in the moist valleys.

The population in some of the lower parts, particularly near the Myitgnan valley, is comparatively dense; so much so, that instead of shifting their habitations and clearings annually to another locality, they have been obliged to adopt a system of rotation in their hill clearings, their fields remaining fallow for three years only, after which the grass and bushes which grow up during that time are cut down and burnt, to obtain a new crop.

The number of villages on elevations exceeding 3,000 feet is small, and two or three only are located higher than 4,000 feet. Yet deserted toungyas are occasionally met with as high as 5,000 feet. The number of villages in the immediate vicinity of the mountains here described amounts to about 15, with a population of from 1,000 to 1,500 souls. One-third of these acknowledge the authority of the Deputy Commissioner of Toungoo, one-third (those on the east side) pay tribute to the Karenee chiefs, and one-third are in a state of savage wildness. A number of these villages are Christian, connected with the American Baptist Mission; and the possibility of obtaining the assistance of these people would be an advantage in forming an establishment on these hills.

Facilities for communication, and general remarks.

9. The distance of the mountains here described from Toungoo is 40 miles as the crow flies. From Shoaegyeen the distance in a straight line is 56 miles, but the access from this place would be far more difficult. From Toungoo a road might be cleared practicable for ponies and elephants, leading in two or three marches to the foot of the range. One march would then bring the traveller to the water shed between the Sitang and Salween, the average height of which is 5,000 feet. It would, however, scarcely be advisable to select this spot either as a sanatorium or for the cultivation of cinchonas. It would be preferable to go one march further to the south, and to select a higher elevation.

But it is clear that the want of villages in the neighbourhood, and the great distance from the nearest station, would render the establishment there of a European superintendent of cinchona plantations a matter of great difficulty. He would not easily succeed in inducing a sufficient number of natives to settle in a locality where the Karens themselves have never settled before; and if he succeeded in obtaining labourers, he would run the risk of finding himself deserted whenever sickness broke out, or the weather became too cold. Another difficulty would be the expense of maintaining an establishment in a place like this. The carriage of provisions and stores alone from Toungoo, where a coolie employed in town cannot be hired for less than 12 annas a day, would be excessive. To this must be added, that the journey up the Sitang river from Rangoon to Toungoo occupies from 15 to 20 days.

Under these circumstances it does not appear justifiable to select the mountains between the Sitang and the Salween, in the first instance, for the establishment of a cinchona plantation.

If hereafter the mountains here described should be found to offer sufficient inducement for the formation of a sanatorium, greater facilities would be given for the establishment of cinchona plantations on these mountains, and it is not impossible that they will prove successful.

28 December 1859.

(signed) *D. Brandis.*

Enclosure 8, in No. 23.

(No. 38.)

From *W. Grey*, Esq., Secretary to the Government of India, to *C. Beadon*, Esq., Secretary to the Government of India, with his Excellency the Governor General, dated Fort William, 9 January 1860.

Sir,

IN the Despatches noted on the margin, the Secretary of State notified the intention of Her Majesty's Government to depute a confidential officer to South America, to collect a large supply of the best cinchonas, in order to try thoroughly the experiment of introducing the culture of this valuable product into India and Ceylon. The plants were expected to reach India in the early part of 1861, and this Government was directed to determine what measures should be taken preparatory to their arrival, and what localities should be selected in this Presidency* for the experiment.

Home department.
Public No. 59 of
1859, dated 9 June.
Public No. 99 of
1859, dated 7 October.

2. Reports on the subject were accordingly called for from the Agricultural and Horticultural Society, from Dr. Thomson, the Superintendent of the Calcutta Botanical Garden, and from Dr. Jamieson, the Superintendent of the Botanical Gardens in the North-Western Provinces.

3. The society suggested Darjeeling, or Sikhim, the Khasya Hills, the Hills in Chittagong and Upper Assam and the Tenasserim provinces, as best adapted for the experiment, and they recommended that proper officers should be appointed to be in readiness to receive the plants, and to convey them to their destination.

4. Dr. Thomson advocated the restriction of the experiment in the first instance to the Khasya Hills; and he suggested that a practical botanist should be appointed at once to go and reside in those hills, in order that he might select, after a full experience of the climate, the exact localities which should appear suitable.

5. Dr. Jamieson expressed an opinion that the locality to be selected must depend upon the species of the plants which might be brought to this country, some species of the cinchona requiring a more temperate climate than others.

6. While these reports were under consideration, the President in Council has received the accompanying Despatch, No. 119, dated 24th November 1859, and its enclosure, from the Secretary of State, from which it would appear that the experiment of the introduction of the cinchona tree into India is intended to be confined for the present to the Neilgherry Hills, in the Madras Presidency.

7. His Honour in Council therefore considers that it is not necessary to take, at present, any further steps in accordance with the previous Despatches of the Secretary of State, dated respectively the 9th June and 7th October 1859. The correspondence which has already passed will be reported home, and a copy of the Despatch of the 24th November, and of its enclosure, will be communicated to the Governments of Bengal, the North-Western Provinces, and Bombay, for information.

8. An interesting memorandum, furnished by Dr. Brandis while recently on a visit to Calcutta, on the suitability of Pegu, Tenasserim, and Martaban, for the growth of the quinine-yielding cinchonas, is submitted herewith for his Excellency's information.

I have, &c.,
W. Grey,
Secretary to the Government of India.

* The Government of Fort St. George, and, it is presumed, the Government of Ceylon, were addressed direct by Her Majesty's Government.

— No. 24. —

From Mr. Clements Markham to Mr. T. G. Baring.

Sir,

India Office, 20 July 1859.

THE question of introducing plants and seeds of the quinine-yielding cinchona trees of South America into India has become very important since the immense consumption of quinine has increased the demand, and the rapid destruction of the trees has rendered the supply exceedingly precarious. During the years 1857-58, the supply of quinine cost the Indian Government upwards of 53,000 l.

Lord William Bentinck suggested the advisability of this measure, more than 20 years ago, and it has been discussed, at intervals, ever since, without any attempt, worthy of the name, being made to procure the plants and seeds from South America.

Last April, Lord Stanley, in Council, determined to send me to Peru, to procure seeds and plants of the cinchonas, and to convey them to India. It is absolutely necessary that this should be done in one season; but I should, of course, only be able to proceed to one particular region, and to procure one species, while there are at least eight of the more valuable species scattered over a space of more than 1,400 miles, along the eastern slopes of the Andes.

If the thing is worth doing at all, it is worth doing well; all these eight species ought to be procured, they are all valuable, and it is impossible to say which might thrive best in India; while the chances of final success are much increased by trying all the more valuable species.

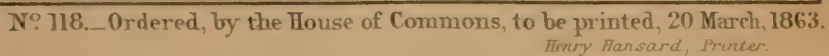
I venture to address you, as to the way in which this important enterprise ought to be undertaken, in the hope that you may support a plan of operations on a more extensive scale than is at present in contemplation, and which, by giving a better prospect of success, will prove more economical.

It is now merely intended to send me to Peru, with a gardening assistant, to procure plants and seeds, and to convey them to India in the best way I can. The dangers, accidents and hindrances which might thwart me at every turn, decrease the chances of success, because the whole thing would depend entirely upon the luck of one individual. In my opinion four separate expeditions should be sent in four different directions, their collections should be received on board one vessel, and taken direct to India; and thus all the eight more valuable species of cinchonas would be obtained. I will briefly touch upon each of these four expeditions, and state my views as to the best way in which they might be undertaken.

I. Beginning from the south, the most valuable species of cinchona, containing the largest per-centage of sulphate of quinine, is the *C. Calisaya*, found in the forests of Bolivia, and the Peruvian province of Carabaya, where the *C. micrantha*, which is also valuable, is likewise met with. I propose to undertake this region myself, and, landing in the Peruvian port of Islay, to proceed to these forests. There will be many difficulties, amongst which may be mentioned the jealousy of the native governments, the difficulties in penetrating into the dense virgin forests, in finding the trees, and in conveying the plants and seeds along the dangerous route to the coast. I trust, however, through my knowledge of the country, the people, and the languages, to surmount these difficulties, and to procure a supply of the *C. Calisaya* and *C. micrantha*, conveying them to the port of Islay.

II. The forests of Huanuco and Huamalies, 250 miles from Lima, abound in two species of cinchonas, the *C. nitida* and *C. glandulifera*, which yield a valuable alkaloid, fetching a very high price in the European markets, and much used in intermittent fevers. I would suggest that I should be empowered to secure the services of some competent person, should I succeed in finding one either in England or at Lima, to proceed to the forests near Huanuco, and procure seeds and plants of these cinchonas, to be delivered to me on my arrival at Callao, from Islay.

III. The forests near Cuença and Loxa in the Republic of Ecuador, produce
barks,



barks, second only to the *C. Calisaya* of Bolivia, called *C. Chahuarquera* and *C. Uritusinga*, varieties of the *C. Condaminea*; while the valuable red bark is found at Huaranda, on the road between Quito and Guayaquil. A Company formed in London, for the purpose of developing the resources of land allotted by the Government of Ecuador for the discharge of its debt, and called the "Ecuador Land Company," has made an offer to this office to procure seeds and plants of the above cinchonas, to be delivered at the port of Guayaquil; but should no arrangement be made with this company, I trust that a botanist, now in the country, will be employed to perform this service; and I should receive the seeds and plants from him at Guayaquil.

IV. In the forests of Nueva Granada there are two valuable species of bark trees, the *C. Pitaya* and *C. lancifolia*, which have lately been imported into Europe in great quantities, especially between the years 1849 and 1855. A person has offered to procure these species for Government, who is well acquainted with the bark collectors, and with the principal men in Nueva Granada. He should be directed to deliver them to me, at Buenaventura, a port in the Pacific.

If these four enterprises were sanctioned, I should, after safely depositing my own collection on board a vessel at Islay, go up the coast to receive the collections from the Huanuco forests, at Callao; from the Ecuador forests, at Guayaquil; and from Nueva Granada, at Buenaventura; then sailing direct to India.

No arrangement has yet been made for supplying me with a suitable vessel to convey the collections of seeds and plants from South America to India; yet this is the most important part of the whole enterprise; its success depends entirely on the rapidity with which the plants and seeds, which are very perishable, can be taken to their destination. There are upwards of 10 Government vessels on the Pacific station; two are stationed at Vancouver's Island, and another bears the admiral's flag, but all the rest are doing nothing particular; and I would suggest that, when the time comes, a requisition might be made to the Admiralty for the use of one to convey the collections across the Pacific to India. At all events, if this is refused I ought to be empowered to charter a vessel for the purpose; but the use of one of Her Majesty's vessels, especially a steamer, would be the best and cheapest way of bringing the objects of the enterprise to a successful result.

I believe that the Neilgherry Hills will be found to be the best locality for planting the cinchonas; and if this is reported to be the case, the vessel would go direct to Calicut, and the Ward's cases containing the plants might be conveyed to their destination in the hills within three days. The celerity of their removal and the shortness of the journey are very important points. The superintendents of botanical gardens in India have been called upon to report their opinion on the best localities for the growth of the cinchonas; and both Darjeeling and Ceylon will probably be tried as well as the Neilgherries.

I am sent out single handed; I may succeed, and assuredly no efforts of my own will be wanting; but the chances of success will be greatly increased, and the undertaking will be far more complete if the measures which I have indicated in this letter, are adopted.

I intend to leave England in December next, so as to be in the forests by April and May, when the seeds are ripe.

I have, &c.

(signed) *Clements R. Markham.*

— No. 25. —

MEMORANDUM, by Mr. *Markham*, on the means of conveying the Cinchona Plants from South America to India.

15 September 1859.

WITH reference to the question of supplying a vessel for conveying the collections of seeds and plants of the quinine-yielding cinchona trees to India, which I have been commissioned to procure in South America, I beg to submit the following remarks in obedience to Mr. Baring's desire.

The best and surest plan would, of course, be to induce the Admiralty to place one of their vessels on the Pacific station, at the disposal of the India Office, for this service. Besides the flag ship, there are, I believe, six or seven of Her Majesty's vessels on the west coast of South America, three of which are steamers, and one of them, the little "Vixen," would be peculiarly well adapted for the service in question. In going direct from Callao to India, with a fair trade wind most of the way, she need not be absent from her station for more than eight months, and the India Office might engage to pay for the wear and tear, coaling, &c. This would be by far the simplest, cheapest, and best way of conveying the plants; and the Admiralty are scarcely likely to raise any objection. The vessel would be required in the Autumn of 1860.

Should the Admiralty refuse to give any assistance, one of the steamers of the Indian Government, either from Bombay or Calcutta, might be sent over to South America to receive the plants; and this was, I believe, the plan adopted by the Netherlands government when they undertook the introduction of cinchonas into Java.

In case both these plans should fail, and no Government vessel should be supplied to perform this service, I ought to be empowered to freight a sailing vessel at Callao. There would be no difficulty in doing so, but of course the voyage would be much longer, and the expense much greater. I am afraid that the freight of a suitable vessel would certainly not be less than 700*l.*; but even this sum is insignificant in comparison to the benefits and advantages which may be expected from the introduction of cinchonas into our Indian possessions.

Finally, if every means of conveying the plants direct to India is withdrawn, I should take a passage in the mail steamer from Callao to Panama, thence in the American line of steamers to San Francisco, thence in a sailing vessel to Hong Kong, and so to India. This would involve voyages of doubtful, but certainly of many months duration; and, as I have before stated, there would be but little chance of any of the plants arriving alive. The seeds would stand a better chance.

I cannot, however, doubt that when the importance of the undertaking is considered, either a Government or an Indian steamer will be supplied, or that, at least, I shall be authorised to freight a vessel at Callao.

The undertaking has already been determined upon. I have been diligently engaged for several months in collecting all the information that can be procured in Europe, and in making necessary preparations, and the Ward's cases, which will be required (worth nearly 50*l.*), are on the point of being shipped off round the Horn to meet me on my arrival at Callao. Mr. Spruce, also a botanist of some eminence, now in the Ecuador, has been induced to accept an offer from this office of employment on a similar service in that region; and I presume, therefore, that there can now be no idea of abandoning the enterprise on account of any apparent difficulty in conveying the plants and seeds to India.

—No. 26.—

MEMORANDUM by Mr. C. R. Markham, India Office, 13 May 1859.

WITH reference to the statement contained in Mr. Gerstenberg's (the managing Director of the "Ecuador Land Company") letter to Lord Stanley, that the company had already appointed Mr. Spruce, an eminent botanist now in the country, to be their agent for transplanting cinchonas; it appears that Mr. Spruce has received no communication from the company, and that he is not inclined to accept their offer if it should be made. Mr. Spruce is, therefore, free to accept any other offer that may be made to him.

In sending expeditions to procure seeds and plants of the cinchona in South America for introduction into India, much may be learnt, both from the mistakes and the final success of the Dutch undertaking in 1852-54.

Mr. Hasskarl, a gentleman of scientific acquirements, but unacquainted either with the country or the language, was sent out by the Dutch government; but he proceeded to the wrong point in the forests, and arrived too late in the year. Thus a whole season was lost. The following season, however, found him in the

the forests of Caravaya, and he succeeded in collecting a great number of plants of the most valuable kind, but no seeds. He proceeded with his collection direct from Callao to Java, where the plantation is reported to be in a flourishing state; indeed the Netherlands government boast that they have done good service to, and may reckon on the approbation of, the whole civilised world.

They, however, only procured one of the valuable species of cinchonas, and at an enormous expense.

By the employment of Mr. Spruce, as well as of myself, the British Government will be able to procure at least three of the more valuable species, and perhaps more at a moderate outlay. Mr. Spruce would be employed to collect the *C. Condaminea* in the forests of Ecuador, while I should direct my labours either towards the Province of Huanuco, or towards that of Caravaya. The whole collection of plants and seeds would be united at Callao, and I should personally superintend their conveyance to India.

If my proposal should be adopted, I would suggest that Mr. Spruce should be addressed directly from this office, or through Mr. Cope, Her Majesty's Consul General in Ecuador, in a letter offering to employ him for the purpose of making a collection of cinchona plants and seeds, in the forests of Ecuador, to be delivered at the port of Guayaquil, for a reasonable remuneration. The details as to time, &c. should be left for arrangement between myself and Mr. Spruce. It will also be advisable to address a letter to Dr. Thomson, of the Calcutta gardens, Dr. Cleghorn, of the Madras forest conservancy, and Mr. M'Ivor, superintendent of the gardens on the hills (Neilgherry), instructing them to report upon the localities in India best suited to the growth of the plants; and to obtain all possible information of the state of the cinchona plantations of the Dutch in Java up to the most recent time.

— No. 27. —

MEMORANDUM by Mr. Markham, India Office, 8 September 1859.

WITH reference to the permission I received from the Revenue Committee, on the 13th of last May, to put myself in communication with Mr. Spruce, a botanist now in the Republic of Ecuador, in order to ascertain upon what terms he would be willing to procure seeds and plants of the more valuable species of cinchonas, which are found in that territory, for the Indian Government; I have now to report that I have received Mr. Spruce's reply to my letter.

Mr. Spruce says, "My services are at the command of the India Office, for the object of procuring young plants and seeds of the most valuable kinds of cinchonas for transportation to India. My present occupation yields me about 20 *l.* a month, and as the one proposed to me is of uncertain duration, I think 30 *l.* a month is as low as I could rate my services, besides the expenses incurred in collecting and transmitting the plants to Guayaquil."

The offer made by Mr. Spruce, with respect to his salary, is very moderate. Mr. Fortune, a man of less knowledge and education, received 500 *l.* a year for his services in the transportation of the tea plants from China to India, a much less onerous duty than the one under consideration. Sir William Hooker says, that "the terms offered by Mr. Spruce are particularly liberal, and it is a great saving to Government that he is already in the field of his labours, and thus the expense of the voyage is saved."

Sir William Hooker, in his letter to me, speaks very strongly upon the necessity of a thoroughly good practical gardener accompanying each scientific collector, and he considers this to be an imperative requirement.

Through Mr. Spruce a supply will be obtained of the *C. Condaminea*, one of the most important species, and of the *Cascarilla roja*, the bark of which is exceedingly rich in valuable alkaloids. He will undertake to have a good supply of young plants and seeds at the port of Guayaquil by the time that I shall have completed my collection. The expenses of transmitting the plants and seeds from the forest to the port cannot be exactly estimated, but Mr. Spruce will endeavour to perform this service as economically as possible, and Sir William Hooker speaks of him as a first-rate botanist, a well-educated and most honourable man.

I would, therefore, suggest to the Committee that I should be authorised to

close with Mr. Spruce's offer, and to make all necessary arrangements with him. I would also request, that I should be permitted to send him out a few things with which it is essential he should be provided, such as Weddell's and Howard's works on the quinology of the Ecuador, and instruments for ascertaining the position, elevation, and temperature of the localities where the cinchonas grow. The Wardian cases which will be required for his collection, will go out with mine, round the Horn.

It is of very great importance for the success of the enterprise, which has now been undertaken by the Secretary of State in Council, that as many of the valuable species of cinchonas as possible should be introduced into India. This is the opinion of Mr. Howard, the largest quinine manufacturer in England; of Dr. Weddell, the highest European authority on all questions respecting these plants; and of Sir William Hooker. Of the four regions which it is necessary to explore, in order to complete the undertaking satisfactorily, and to procure all the more important species of cinchonas, two will thus be provided for. I shall myself endeavour to collect plants and seeds of the *Calisaya*, the most highly prized bark of all, and of two other valuable species, the *micrantha* and *Zamba morada*, in the forests of Caravaya; and Mr. Spruce will obtain a supply of the *Condaminea* and *Cascarilla roja*, in Ecuador.

It is necessary, however, for the complete success of the enterprise, that the more important species of cinchonas in New Granada and in the forests of Huamalies and Huanuco, in Peru, should also be procured.

I have received an offer to procure these cinchonas, from Mr. Bollaert, a gentleman who was mentioned by Dr. Royle as well qualified to perform such a service. He has been many years in South America, knows the language, has had much experience in travelling in those countries, and is personally acquainted with several of the cascarilleros or bark collectors of New Granada. I trust that the Committee will authorise me to put myself in communication with this gentleman, with a view to ascertain the terms on which he would be willing to undertake this portion of the enterprise. This would still leave the forests of Huanuco and Huamalies unprovided for.

With regard to the conveyance of the collections from the west coast of South America to India, I would venture to remind the Committee that there is very little chance of succeeding, unless a vessel is specially provided for the purpose.

— No. 28. —

RESOLUTION of a Revenue, Judicial, and Legislative Committee, India Office,
22 September 1859.

APPROVED by the Secretary of State in Council.

THE Committee having had before them a memorandum by Mr. Markham, reporting that, in pursuance of an order received by him on the 13th May last, to ascertain upon what terms Mr. Spruce, a botanist, now in the Ecuador, would be willing to procure seeds and plants of the more valuable species of cinchonas which are found in that territory, for the Indian Government; he wrote to him, and has received a reply from Mr. Spruce, stating that he is willing to undertake that service for 30 *l.* a month, besides the expenses incurred in collecting and transmitting the plants and seeds to the port of Guayaquil.

The Committee having further considered that part of Mr. Markham's memorandum referring to the great importance of introducing as many of the valuable species of cinchonas into India as possible; and representing the necessity of providing a vessel for conveying the collections of plants and seeds from the West coast of South America to India:—

Ordered, that Mr. Markham be instructed to close with Mr. Spruce's offer, on the part of the Secretary of State for India, in Council; that he be authorised to expend sums not exceeding 500 *l.* for each region, in procuring plants or seeds of the more valuable species of cinchonas, which grow in New Granada, and in the provinces of Huamalies and Huanuco in Peru, if opportunities of doing so should offer themselves; and to charter a vessel on the west coast of South America, for the voyage to India.

— No. 29.—

Clements R. Markham, Esq., to Dr. Forbes Watson.

My dear Sir,

Lima, 8 February 1860.

I WRITE by this mail a short report of my proceedings thus far, which you will perhaps kindly show to Mr. Bourdillon.

On January 19, I arrived at the port of Guayaquil, in the Republic of Ecuador, and made arrangements with regard to Mr. Spruce's part of the undertaking. We found the President of Peru, with a large fleet and army in hostile possession of the river and a part of the town, and the country in a complete state of anarchy. I had some conversation with Castilla, the President of Peru, with our Minister, Mr. Cope, and with the Vice-consul Mr. Mocatta. The latter has got passports, so as to prevent any of Mr. Spruce's mules from being seized, and will make all necessary arrangements about sending Cross up the river with the Wardian cases when he arrives. Cross should, therefore, be told to go to him on his arrival at Guayaquil; and I think he should also be provided with a letter to Her Majesty's Acting-consul at Panama, Mr. Bidwell, as he has never travelled before.

I think there is every prospect of Mr. Spruce's undertaking being successful; and I have told him to send the plants and seeds in charge of Cross, by the first steamers to Southampton, and thence, without delay, to India. He will collect chiefly, I believe, in the forests where the "red bark" is found.

On January 26th I arrived at Lima, where I remain for a short time, to collect information, make some necessary arrangements, and obtain letters of introduction.

I have met several persons connected with the forests on the eastern slopes of the Cordilleras, such as Don José Maria Costas, Don Modesto Basadre, and others; and they all tell me that good cinchona trees have become exceedingly scarce, both in the forests of Carabaya and Bolivia; that 10 years ago, when Dr. Weddell was out here, it would have been comparatively easy to make a large collection, but that now it will be an enterprise of very great difficulty. The natives, both in Peru and Bolivia, have lately become extremely jealous of strangers, and there is almost the certainty of a war between those two Republics in a few months. The obstacles in the way of success are of no small magnitude; but at the same time every year of delay would most undoubtedly greatly increase them.

John Weir (the gardener) is now at Islay, putting together 15 of the Wardian cases in a court-yard which has been provided for the purpose; the other 15 will be sent to Guayaquil for Mr. Spruce, by the first opportunity. The freight from Callao to Islay, and custom-house charges were exorbitant; but I keep a regular account of all expenses.

On my arrival here, a long complimentary article appeared in the "Lima" newspaper, announcing my second visit, and reviewing my former works. This has, I think, thrown the people off the scent as to my real object, although it must necessarily be known to several. The extreme scarceness of the trees has made me doubtful whether to go to Carabaya, or to alter my plans, and enter some of the Bolivian forests, the objection to the latter course being the lawless and unscrupulous character of the Bolivians; the position of whose country on the other side of the Andes, enables them to defy European governments. I shall probably be unable to decide finally until I am much nearer the theatre of action.

With regard to conveying the plants from here to India, I have consulted several people, consuls, merchants, and captains of vessels; and have come to the conclusion, if no steamer is provided in the Pacific, that the best route will be by steamers to Southampton, and thence by the ordinary line to India. There is the certainty of having steam all the way, the Wardian cases would be safer, and there would be no necessity of engaging freight beforehand: while to obtain freight in a vessel from Callao would be ten times as expensive, with greater risks. Another advantage would be, that in case I am knocked over by fever and ague, or any accident, there will be no difficulty in Weir taking charge of the cases to India; as Cross will do with Mr. Spruce's collection.

The secretary of the Royal West India Mail Steam Company (55, Moorgate-

street (E.C.), should be requested to give directions to the captains of the company's steamers to render every assistance in their power, and to give accommodation for the cases aft, on the upper deck, and that their agents on the Isthmus should take charge of their conveyance from the Pacific to the Atlantic. Mr. Just, the secretary of the Pacific Steam Navigation Company (Liverpool), and the Peninsular and Oriental Company should also be written to, for the same object. I think the Peninsular and Oriental boat sails four days after the arrival of the West Indian mail at Southampton.

I am now about to proceed to Arequipa, and shall continue my journey to the forests; as soon as the roads are practicable. Whatever the result of my enterprise may be, be assured that I shall do my best and spare no labour, neglect no chance, for the attainment of the important object in view.

Ever yours, &c.
(signed) *Clements R. Markham.*

P.S.—I shall write next from Arequipa.

— No. 30. —

From *C. R. Markham, Esq.*, to *Dr. Forbes Watson.*

Port of Islay (Coast of Peru),
5 March 1860.

Dear Dr. Watson,

* I have sent the other 15 Wardian cases to Guayaquil to await the arrival of Cross, or further orders from Mr. Spruce.

I HAVE got the 15 Wardian cases* here, all put together, ready to receive the plants, without further accident than the breaking of one of the panes of glass. They will remain here, under a corridor, until my return from the interior. While here, waiting the arrival of beasts from Arequipa, I have been examining the ravines in search of good soil for the Wardian cases.

Islay is a little sea-port, surrounded by a sandy desert, which extends inland as far as Arequipa, a distance of 90 miles, and the soil of the latter place is poor, and, therefore, not likely to be suitable for the cinchona. A range of mountains, however, averaging a height of 1,500 to 2,000 feet, runs along the coast, at a distance of about a league or two from the sea, called the Lomas. From June to December they are green, and covered with wild flowers, but dried up during the remainder of the year. They are broken by several ravines which descend towards the coast, where small springs are met with, causing vegetation, and giving live to a few olive, fig, pomegranate, and acacia trees; those near Islay are called Mataranes, Yuta, Guerreros, through which the road to Arequipa passes, Tintayale, and Catarindo.† From the little springs of Mataranes, a pipe is laid down, which supplies Islay with water; and, amongst the roots of the olive trees, in this ravine I found soil, apparently rich, and suitable for the Wardian cases. Owing to the extraordinary rains, a number of plants were still in flower; so that I found, in the soil of the Mataranes ravine, olives, figs, acacia, an amaranth, verbena (two kinds), heliotrope, salvia, several compositæ, a little grass, a poppy, tobacco, castor oil, a rumex, a convolvulus, solanum (two kinds), an umbellifer, aloe, and oxalis. In July there are great quantities of amancaes, a liliaceous plant.

By this post, I forward to your address, a small bag, containing a sample of the soil of Mataranes, for analysis, together with specimens of the rock, apparently gneiss, of which the ravine is formed. I also enclose a sketch map of the locality. I shall be obliged, if you would forward me the result of the analysis of this soil,‡ and if it contains nothing pernicious, its proximity to Islay (less

† Amongst the papers on cinchona, in the office, you will find an analysis of soil, where a cinchona grew, by Mr. Piddington, with this result:

100 grains of water	-	-	-	-	-	-	-	2.06
Siliceous matter	-	-	-	-	-	-	-	0.62
Carbonate of lime	-	-	-	-	-	-	-	46.00
Carbonate of magnesia	-	-	-	-	-	-	-	51.00
Loss	-	-	-	-	-	-	-	0.32
								100.00

Memorandum, dated 21 November 1856.

(less than a league), will enable me to obtain it quite fresh, when the plants arrive on the coast. Meanwhile, I have made arrangements for a sufficient quantity to be ready for the Wardian cases; and I shall find your answer to this letter when I pass through Arequipa in time, if the analysis is unfavourable, to procure soil elsewhere. I shall bring down specimens of the soil in which the cinchonæ grow (at a foot deep, near the roots) together with bits of the rock, and loose stones near them. I shall also be obliged, if you would let me know what the fine white powder is composed of, which is scattered over the desert, and a specimen of which I have also forwarded in the bag.

I have examined these ravines, and traversed the sandy desert on foot (as they have no beasts here), and frequently under a burning sun.

War is about to commence between Peru and Bolivia, and it will be right in my line of march; they also tell me, that the cascarilleros will try to prevent my procuring plants and seed, but I will overcome these difficulties if it is possible.

I leave this to-morrow morning for Arequipa, whence I will write again.

Ever yours, &c.

(signed) Clements R. Markham

— No. 31. —

C. R. Markham, Esq., to E. D. Bourdillon, Esq.

Dear Sir,

Arequipa (Peru), 20 March 1860.

IN acknowledging the receipt of your letter dated January 24th, I take the opportunity of reporting my proceedings, in continuation of my letter dated from Islay, in answer to that addressed to me by Dr. Forbes Watson, on December 31st, 1859.

With my letter from Islay I forwarded some soil for analysis, which, after some search, I had found in the neighbourhood of that port, hoping that it would be found suitable for establishing the cinchona in the Wardian cases. I have since examined the soil in the valley of Arequipa,* and find that it is poorer, and that in most parts, especially where maize crops are raised, a great deal of guano is used. This makes me more anxious that the soil of the "Lomas" of Islay may contain nothing pernicious.

* Most of the wild flowers of the Lomas of Islay, however, are also found in the valley of Arequipa.

Mr. Wilthew, Her Majesty's Consul at Islay, has kindly made arrangements to have the soil ready when I arrive from the interior, and the Wardian cases conveniently placed for the reception of the plants.

I arrived at Arequipa, after a two days' ride over the desert, on the 8th of this month, and find that this is the rainiest season that has ever been known in Peru since the year 1819, and that the roads over the Andes are said to be impassable. Nevertheless, as the rains must necessarily be drawing to a close, and as I am anxious not to lose any time, I intend to leave Arequipa for the interior on the day after to-morrow, March 22d.

During my stay here, I have been carefully collecting information respecting the bark trade; chiefly from Mr. Renny, the agent of the house of Gibbs, Don José Maria Peña, an exporter of Bolivian bark, and Don Agustin Aragon, one of the principal men of the Carabaya province. All commercial men combine in saying that the bark of Carabaya is of little value, and the house of Gibbs has forbidden its agents to purchase it; and they assure me that all calisaya bark comes from Bolivia, either through the port of Arica, or smuggled across the frontiers of Arequipa and Islay. On the other hand, Dr. Weddell, Dr. Junghuhn, and other botanists, whose statements are confirmed by Don Agustin Aragon, assert that the shrub calisaya (var. *B. Josephiana*) is the same plant as the tree calisaya, only growing under different circumstances; and this variety abounds in Carabaya, though little sought after, on account of the small quantity of bark it yields.† Moreover, Dr. Weddell, in a letter to me, dated September 20th 1859, assured me that small plants of the tree calisaya were common in the forests of Carabaya; and this assertion is also confirmed by Aragon. Other valuable species of cinchona, such as the *Zamba morada*, *C. Boliviana*, and *C. micrantha*, are known to abound in Carabaya.

† Dr. Weddell, in a letter to me, dated 10 August 1859, advised me by all means to collect the *C. Josephina*.

I am thus left in the difficult and very responsible position of having to select the region in which to work, and on the correctness of my decision will depend the success of the undertaking, at least for this season.

The case as between Bolivia and the Peruvian province of Carabaya, so far as I am now informed, stands thus: In the Bolivian forests there is undoubtedly the greatest quantity of *C. Calisaya* trees, but the difficulties of procuring plants and seeds is very great. The Bolivians are the most ignorant, barbarous, and jealous of all the South American republicans, and they have an intense hatred and suspicion of foreigners. Both the authorities and the bark collectors, when my object was known, would throw every obstacle in my way, and not improbably imprison me. Besides all this, a war between Peru and Bolivia appears to be certain as soon as the dry season comes on, which would render the conveyance of the plants across the frontier in safety almost impossible.

In Carabaya it is true that the tree *Calisaya* is rare; "that is large ones, for the small ones are common;"* and the shrubby variety, together with other valuable species can, I am told, be easily procured. The road from the forests of Carabaya to the coast is shorter than from any point of the Bolivian forests; the Peruvian authorities would give me every assistance in their power in the way of supplying me with mules, collecting provisions, and obtaining experienced guides; at the present moment, the Peruvian Government having quarrels with France, and the United States, is particularly anxious to keep on good terms with Great Britain during its war with Bolivia; and my route to the coast will probably be beyond the actual scene of the approaching campaign.

Having carefully weighed these considerations, it is my present intention to proceed in the first place to La Paz, the principal city of Bolivia, where Mr. Jerningham has supplied me with a letter to the Minister of Foreign Affairs; and then to continue my journey along the verge of the Bolivian forests, until I again reach the eastern banks of the Titicaca, on the frontier between Peru and Bolivia. I should, during this journey, collect information, and form my judgment by personal observation, and if I came to the conclusion that the risk of personally attempting to make my collection in Bolivia would be so great as to render success improbable, I should abandon the idea, and endeavour to make some such arrangement with the agents of Don José Maria Peña, as Mr. Hasskarl made so successfully with some Bolivian cascarilleros.

Having thus done all in my power with regard to Bolivia, I shall proceed to the forests of Carabaya in May, in time to see the cinchona in flower, and commence at once to work at making as large a collection as possible in the southern division, and as near as possible to the Bolivian frontier. The *C. Boliviana*, which Dr. Weddell believes to be hardly more than a variety of the *C. Calisaya*,† is found in abundance in Ayapata, the northern district of Carabaya, where Don Agustin Aragon has a large estate, and I shall endeavour to make an arrangement with him to supply me with plants of that species.

Don Pablo Pimentel, the present Sub-Prefect of Carabaya, will be directed to give me every assistance; and the cura of the frontier village is my personal friend, so that I anticipate no difficulty in procuring guides and a sufficient stock of provisions to enable me to proceed into the forests. I hope to complete the collection by September, and to reach the coast during the same month.

With regard to the conveyance of the plants and seeds to India, I am still of opinion that by far the safest and cheapest way would be by sending a Government steamer direct from the coast of Peru to India, as was done by the Dutch; and that every other way involves numerous risks and chances of failure. Of the two other ways that are left, namely, by steamers to Southampton, and thence by the overland route, or by a sailing vessel across the Pacific; I am convinced that the former, with all its risks, is preferable for many reasons. In obtaining a vessel there would be many delays, a necessity of waiting for the Ecuador collection, the chance of calms on the Line, much more expensive, and under the most favourable circumstances a longer voyage. I should not therefore think of taking any steps respecting the "Kittiwake." By the former way there would be the great advantage, that the collections from Southern Peru, and from Ecuador could be sent away at once, without waiting for each other. It is true that there would be more risk from the numerous trans-shipments; but by having proper directions given to the various captains, and with ordinary care, I have no doubt that the Wardian cases might be conveyed without accident to India by this route.

I would

* Weddell to me,
20 Sept. 1859.

† Weddell to me,
20 Sept. 1859.

I would repeat, however, what I have already said in a former letter to Dr. Forbes Watson, that the secretaries of the Pacific,* West Indian,† and Peninsular and Oriental Steam Navigation Companies should be written to, requesting that the captains of their steamers be directed to give every assistance and good stowage room on the upper decks. With regard to the passage across the Isthmus of Panama, it would be well to request, that the agent of the West Indian Steam Navigation Company at Panama be directed to see the cases safely conveyed across the isthmus. Mr. Spruce's collections can be sent away (without waiting for mine) in charge of the gardener, Cross.

* Mr. Just (Liverpool).

† Mr. Reep (55, Moorgate-street, E.C.)

I have now, I think, informed you of all that is settled respecting my future movements; which may, of course, be modified by further information that I may receive at Puno,‡ or when nearer the cinchona forests.

‡ I hope to reach Puno on Sunday, 25 March.

In justice to myself, I cannot conclude this letter, which is probably the last that I shall have an opportunity of writing, until my return from the interior, without expressing a hope that the Secretary of State in Council is aware of the difficulty of the service upon which I am employed. The forests where the cinchonæ grow are almost inaccessible, without roads or habitations. There is great risk of being disabled by fevers in the humid forests, by "soroche," (an illness brought on by the great height) in crossing the Andes, and by dysentery and ague on the coast. The plants, after they are procured, will have to pass on mules' backs over the frozen plains of the Andes, and the hot arid deserts on the coast before reaching the Wardian cases; and then will follow several voyages in different steamers, which will last for three months. [It will be remembered that no human foresight could have prevented the loss of the priceless collections of La Condamine, Ruiz and Pavon, Humboldt, Stamford Raffles, Wallace, and others.] The roads from the forests, and across the Eastern Cordillera, pass along the edges of precipices, and over ridges, where one false step would cause the loss of mules and cargo.

Many of these obstacles may, of course, be overcome by energy and care, others are in the hands of Providence; but I take this opportunity of mentioning the many risks and dangers which must be encountered, in justice to myself; at the same time, assuring you that, humanly speaking, I feel some confidence in the success of the undertaking, and that no exertions will be spared on my part.

I have, &c.
(signed) *Clements R. Markham.*

— No. 32. —

T. G. Baring, Esq., M.P., to Clements Markham, Esq.

Sir,

India Office, E.C., 31 March 1860.

Your letter, dated 8th February 1860, No. 1, addressed to Dr. Forbes Watson, has been laid before the Secretary of State for India in Council, and I am directed to inform you that your wishes with reference to the safe transport of such seeds and plants of the cinchona tree as you may be able to obtain, having been communicated to the Secretaries of the West India and Pacific Steam Navigation Companies, the directors have in each case expressed their willingness to issue the necessary instructions to the officers commanding the vessels on which the plants will be placed; on their arrival at Southampton they will be immediately forwarded to their destination in India. Mr. Cross, the gardener attached to Mr. Spruce's branch of the expedition, will proceed to Guyaquil by the steamer of the 17th proximo, as originally arranged; he will be furnished with a letter of recommendation to Her Majesty's consul at Panama, and be instructed to proceed up the river with the Wardian cases to join Mr. Spruce.

Sir Charles Wood notices with pleasure the zeal and intelligence with which you have entered on the duty entrusted to you, and feels satisfied that by the continued exercise of those qualities, you will be able to overcome the many difficulties inseparable from your undertaking. I am directed to convey to you his approval of your arrangements as far as they have already proceeded, and to

add that the change in your plans, with regard to the transport of the seeds, *viâ* the Pacific, appears to be fully justified by the concurrent opinion of people who, from their position, are likely to be well informed upon this subject.

I am, &c.
(signed) T. G. Baring.

— No. 33. —

From E. D. Bourdillon, Esq., to Clements R. Markham, Esq.

Sir,

India Office, London, 17 April 1860.

I HAVE to acknowledge the receipt of your letter, dated Port of Islay (coast of Peru), 5th March 1859 (1860), addressed to Dr. Watson, together with its enclosure and the specimens of earth which accompany it; when they have been analysed you shall be informed of the result of the investigations. The gardener Cross leaves for Arequipa, in accordance with the instruction conveyed in your last letter, by the present mail.

The enclosed letter from Mr. Cleghorn arrived by the last mail; you will see that that gentleman agrees in the Neilghery Hills being the most suitable locality for commencing the experiment for propagating the plants and seeds you may be able to transmit.

I am, &c.
(signed) E. D. Bourdillon.
Clements Markham, Esq.,
Port of Islay, Peru, South America.

Enclosure in No. 33.

H. Cleghorn, Esq., to Clements Markham, Esq.

My dear Sir,

Utakamund, Nilgiris, 7 March 1860.

YOUR letter of November 17th reached me some time ago, whilst travelling to this sanatorium. I would have written sooner, but was much occupied during the stay of Sir Charles Trevelyan at this place. Your plan of operations, and the great object of your voyage is much in my thoughts, and has naturally been much discussed everywhere.

After careful perusal of the pamphlet drawn up by you, I have come to the conclusion that the best sites will be found in the Nilgiri range of mountains, and I concur with you that it will be best at first to concentrate all our efforts in this vicinity rather than to scatter the cases over different districts, as Salem, Tinnevely, and Travancore, which may hereafter be supplied with seeds and cuttings.

The best efforts of Mr. McIvor and myself shall not be wanting to make the necessary preparations, and sites will be put in readiness immediately at the close of the monsoon (end of September), the rapid growth of vegetation during the rains renders any earlier attempt fruitless, except in a few sheltered localities.

So anxious do I feel to co-operate with you in the great work in which you are engaged, that I propose to modify my tour this season, so as to enable me to repair to Calicut as soon as the arrival of the cinchona ship may be telegraphed. Mr. P. Grant, Collector of Malabar, has received instructions from Government to afford you every assistance in facilitating transport up the Nilgiri ascent, and this will be attended with some difficulty, the short ghat road being very steep, whilst the cart road, *viâ* Polyat and Coimbatore, makes a detour through the low country, where the temperature is high. I think the short road will be the best.

It is well to remember that Mr. McIvor's conservatory is just being finished, and that he has a smaller glasshouse, which usually contains some of our indigenous *Melastomaceæ*, *Aristolochiaceæ*, &c.

The Wardian cases, which may be sent to Ceylon, and given in charge to Mr. Thwaites of the Royal Gardens, Peradinea, will be admirably cared for. I believe he is already prepared for your arrival, and writes with enthusiasm regarding the project.

Wishing you a pleasant and successful voyage from S. America to Calicut.

I remain, &c.
(signed) H. Cleghorn.
Clements Markham, Esq.,
India Office.
(To be forwarded.)

— No. 34. —

LETTER from *C. R. Markham*, Esq., to the Under Secretary of State for India.

British Consulate, Port of Islay, Peru,

Sir,

9 June 1860.

I HAVE the honour to report, for the information of the Secretary of State for India in Council, that, in performance of the service on which I am employed, I have arrived at this port with 529 of the more valuable species of cinchona plants, which are now in course of establishment in the Wardian cases, for conveyance to India.

2. I propose, in this report, to give a detailed account of my proceedings, from the time of my departure from the city of Arequipa (whence I addressed my last letter (No. 3) to Mr. Bourdillon), to my arrival, with the plants, at this port. Some of my observations in the cinchona region may prove useful to the gentlemen who will have charge of the cultivation in India, and should it be considered advisable to supply them with printed copies of this report, they should be in their hands one or two mails before the arrival of the plants.

JOURNEY ACROSS THE CORDILLERAS OF THE ANDES.

3. On March 22d, 1860, I left Arequipa, accompanied by John Weir, the gardener, and arrived at the city of Puno, on the banks of Lake Titicaca, on the 27th, a very painful journey, over snowy heights 15,500 feet above the level of the sea, in the worst season of the year, the rigours of which were increased by the debility brought on by an illness from which I had suffered at Arequipa, and by the *soroche*, or violent headaches and sickness, occasioned by the great elevation of this region above the sea. The loftiest part of the road is several hundred feet above Mont Blanc.

4. At Puno, I was occupied for some days in collecting information, which induced me to alter the plans for executing this service that I had previously formed at Arequipa. I found that a war with Bolivia was imminent; that the state of that country, owing to the excessive rains, would render travelling exceedingly slow; and that the extreme jealousy of the Government and people, in preserving their present monopoly of the bark trade, would render it impossible for me to make a collection personally. I have a most complete distrust of all native agency; I therefore abandoned my intention of going into Bolivia, and it was very fortunate that I did so, for a decree has since been issued by Dr. Linares, the President of that Republic, prohibiting all communication between Peru and Bolivia, and the passage of either travellers or goods across the frontier, this being, of course, the forerunner of war between the two countries.

5. There is no question that the calisaya tree, the most valuable species of cinchona, is found in greatest abundance in Bolivia; but, though scarcer and more difficult to collect, it is also to be met with in the Peruvian province of Carabaya. I finally resolved to proceed without delay to the cinchona forests of Carabaya, to make as large a collection as possible myself, without employing any native agent.

6. On the 7th of April I left Puno, and commenced my journey to Carabaya, travelling without a muleteer, and with the cheapest beasts, hired from one village to another, a way which entailed much trouble and annoyance, but which I adopted as being far more economical. There were four broad and very rapid rivers to cross on *balsas*, or long bundles of reed stitched together, while the mules swam. The plains and mountain ranges over which the way passed averaged a height of 12,000 to 13,000 feet above the level of the sea, and one snowy pass attained a height of nearly 17,000 feet. The season was one of violent storms, with hail and snow, and constant rains. The road passed through the towns of Lampa, Pucara, and Azangaro, to Crucero, the capital of the province of Carabaya, which I reached on the 16th of April, a distance of 160 miles from Puno.

7. Crucero is a mere collection of mud huts, built on a very elevated swampy plain, just on the western side of the snowy Caravaya range, whence roads branch, off over the passes to the forest-covered valleys on the eastern slopes.

THE PROVINCE OF CARAVAYA.

8. The Peruvian province of Caravaya, in the department of Puno, consists of a snowy range of mountains, extending for 180 miles from the department of Cuzco to the frontier of Bolivia, from the eastern slopes of which long spurs run out to the north and east, until they gradually subside into the vast forest-covered plains which extend for thousands of miles to the shores of the Atlantic. These spurs or ridges enclose valleys the sides of which are generally covered with dense forest, while the summits of the ridges are clothed with rich pasture land, interspersed with small thickets in the ravines and gullies. These higher regions are called *pajonales*. The numerous streams and rivers which flow down the valleys of Caravaya, and which have long been famous for their gold washings, finally unite, in the plains, to form the river Ynambari, a tributary of the still unknown Purus, which is probably the largest secondary river in the world.

9. The most important of the Caravaya valleys, and that which I determined to examine first, is that of Sandia, which contains a population of 7,000 Indians, and annually yields 90,000 lbs. of coca, and 10,000 lbs. of most excellent coffee.

10. On April 18th I left Crucero, and crossing a lofty snow-covered ridge, commenced the descent from an arctic to a tropical climate, down the beautiful ravine of Sandia. The pass above Crucero is 13,600 feet, and the village of Sandia 6,667 feet above the sea, being a descent of 6,933 feet in 30 miles. Arriving at Sandia on the 20th, I began at once to collect provisions and make other necessary preparation for a further advance into the interior, intending first to examine the *pajonales* of the Sandia valley in search of the β *Josephiana* variety of the *calisaya* plant, which Dr. Weddell had informed me was to be met with in those localities, and then to cross a mountain ridge into the forests of Tambo-pata, where the tree *calisaya* and other valuable species of *cinchonæ* were said to abound.

Cinchona Calisaya, var. β *Josephiana*.

11. On the 24th of April I left Sandia, accompanied by the gardener, a native lad, and three Indians bearing a tent, provisions consisting of toasted stale bread, salted cheese, maize, and a few other necessaries, and proceeded down the valley, following the course of the river. The foaming torrent dashed through the centre of the valley, and the masses of verdure on either side were toned down by many flowers in large patches, purple *melastomaceæ*, orange *cassiæ*, and scarlet *salviæ*. At a distance of 15 miles below Sandia, the perpendicular cliffs rise up from the river on either side to a stupendous height, and the path winds up in zigzags, to creep along the edge of steep grassy slopes or *pajonales*, far above the tropical vegetation of the ravine.

12. It was at this spot that the *Calisaya* (var. β *Josephiana*) was first met with; a number of young plants growing by the road side, and older shrubs lower down the slope, with their exquisite roseate flowers and rich green leaves with crimson veins.

13. The rock appeared to be a hard schist, much discoloured with red oxide, quartz occurring here and there; the soil a stiff brown loam, with a little vegetable mould. A little above the road there was a small thicket of *arbutus* and purple *melastomaceæ*, in a shallow gully, surrounded by the long-bladed grass of the *pajonal* (*stipa ychu*). Here there was a *Cinchona caravayensis*, and another *Calisaya Josephiana*. The height of this spot above the sea was 5,422 feet, and the plants growing round the *cinchonæ* were purple *melastomaceæ*, *arbutus*, and *blechnum* and *trichomanes* ferns. The positions of a number of young plants, to be collected on our return, were noted down.

14. The scenery of this part of the valley is remarkably beautiful. Lofty mountains, with their cascades, rise up on either side, their summits crowned with

with rich grass, their gullies full of trees and flowers. Half way up, in many directions, terraces of coca rise, tier above tier, fringed with ferns and begonias. We have the shrub cinchonæ on the high pajonales, perhaps the finest coffee in the world in the ravine, and a little gilium, also of the cinchonal alliance, by the road sides.

15. On the 26th I travelled for a considerable distance along the skirts of mountains, at a great height, in the region of pajonales. No ravines or large cascades cut up the face of the mountains; all was exposed to the full glare of the sun; and though there was a profusion of melastomaceæ in the shallow gullies, there were no cinchonæ. The latter evidently dislike very exposed situations, at these heights.

16. On this day, also, I left the valley of Sandia, and, crossing a mountain range, went down from the grassy uplands to the banks of another river, the Huari-huari, flowing through a tropical forest full of palms and tree ferns. On the verge of the pajonal there were a number of *Calisayas* (β *Josephianæ*), which were also marked down, to be collected on our return.

17. From the banks of the Huari-huari, a very dangerous and tedious ascent led to the ridge which divides the valley of Sandia from that of Tambopata. The ridge consists of grassy slopes, with dense thickets of melastomaceæ, palms, tree ferns, bamboos, incense trees, and cinchonæ, in all the small ravines and gullies. The useless *Cinchona caravayensis*, with its large red capsules and coarse leaves, was common enough, but the *Calisaya Josephiana* very rare. One calisaya, whether it be the variety α or β of Weddell, was met with on this pajonal, 18 feet 6 inches in height, and $8\frac{1}{2}$ inches in girth two feet above the ground; yet Dr. Weddell gives the height of the *C. Josephiana* as varying from $6\frac{1}{2}$ to 10 feet.

18. I cannot but conclude that the *Josephianas* are not even a variety of the true calisaya, but exactly the same plants, stunted to the size of shrubs from their elevated or exposed situations. I have traced these calisayas from the shrub to the tree, without finding any difference in the flower or fruit to warrant even a variety. While still in the region of pajonales, I found four or five trees, 20 to 30 feet high, with flowers and fruit of Weddell's *Calisaya*, var. α *Vera*.

19. I had but slight opportunities of observing the temperatures of the pajonal region, about 5,000 feet above the sea, where the *C. Josephiana* is found. On April 25th to 27th the thermometer ranged between 7 A. M. and 9 P. M.; highest 67 degrees, lowest at night 56 degrees; and on May 12th to 14th, from 69 degrees to 53 degrees. The shrub calisayas were growing on the edges of the thicket, and not in deep shade.

20. The most common plants growing with the shrub calisayas were the melastomaceæ with purple flowers, and the *huaturu bajo*, or incense trees.

21. In returning from the forests, on May 13th and 14th, 20 plants of the shrub calisaya were collected in the Huari-huari ravine, and 55 on the pajonal where they were first seen, called *Paccay-samana*, most of them very promising young seedlings. Total 75.

Cinchona Calisaya, var. α *Vera*.

22. Having crossed the ridge of pajonales, I entered another of the Caravaya valleys, through which the river Tambopata flows, which rises in the mountains separating Peru from Bolivia. The Tambopata valley was visited by Dr. Weddell in 1847, and its forests were said to abound in cinchonæ. In the upper part of the valley I found a small clearing made by one Juan de la Cruz Gironda, who was obliging and willing to assist me, and I procured an excellent guide named Martinez, a native of the place, who was well acquainted with the forests.

23. With the exception of a few small clearings, the whole ravine is covered with one dense tropical forest, without road or path of any kind, and I resolved to penetrate in the performance of this service, where, as far as I could learn, no European had been before, and no human being for upwards of 12 years, when the bark trade of Caravaya came to an end. I knew the risks

would be great, but that they would be fully justified by the importance of the object to be attained, and on the 1st of May I left Gironda's clearing, accompanied by the guide Martinez, the gardener, and four Indians, carrying a tent and provisions.

24. Beyond the river Challuma, a tributary of the Tambopata, and the extreme point reached by Dr. Weddell, there is no path of any kind, the trees are of great height, and the ground is entirely choked up with creepers, fallen masses of trees and bushes, and tangled bamboos. In many places the way led along the verge of a precipice overhanging the river, which boiled and surged many hundreds of feet below. Our encampments were made each night on any stony beach we could find where there was space to light a fire and pitch the tent, and all day we toiled and struggled through the closely-woven jungle.

25. On the 3rd of May I reached the confluence of the rivers Yana-mayu and Tambopata, where I formed an encampment, and resolved to make a thorough examination of the surrounding forests.

26. The forenoon of that day was devoted to the forest on the south-west side of the Yana-mayu ravine, a steep declivity, the lower part of which is covered with ferns, bamboos, palms, some spurious cascarillas,* and trees with buttressed roots of stupendous size, to a height of 400 to 600 feet, when the calisaya region commences. In this locality 25 plants of the *Calisaya*, var. *a Vera* of Weddell were collected, two of them seedlings, the remainder root shoots, but with good roots of their own. The search was exceedingly fatiguing and dangerous work, scrambling through matted undergrowth and up steep declivities, in drenching rain, with rotten vegetation and saturated moss under foot.

27. In the afternoon we examined the forest-covered heights on the north-east side of the Yana-mayu, and 21 more calisayas were collected. I concluded, from observations made on this day, that the calisaya avoids the banks of a river, never being found within several hundred feet of it, that it prefers the steepest declivities of the mountain sides, and a great deal, though not too much, shade. When in very shady places, it loses the purple hues on the petioles and mid-ribs. The plants were growing in moss, a few feet deep, which clung to the rocks.

28. On the 4th I made a toilsome and dangerous forest journey, along the most giddy precipices, overhanging the river, with no foot-hold but decaying leaves, nothing to grasp but rotten branches, every motion a drenching bath from the wet branches, every other step a painful and dangerous slip or fall. This tract of forest was remarkably bare of cinchonæ, without any apparent cause, and only ten calisayas were collected during the whole day. I also stripped the bark off a young tree to bring home as a specimen.

29. On the 6th, the whole day was devoted to the search of a forest-clad height, on the south-west side of the Yana-mayu, called the "Naregada de Yana-mayu;" and as this was a very successful day's work, and the locality seemed well adapted for the growth of the calisaya, I will describe it in some detail.

30. From 500 to 600 feet above the river, a ridge of rocks juts out from the forest-covered sides of the ravine, which is not nearly so densely covered with vegetation, where there are no palms, tree ferns, or plants requiring excessive humidity, and where young plants receive shade from taller trees, while they also enjoy plenty of sunshine through the spreading branches. The most common trees at this spot were the *Melastomaceæ*, a tall grass called *Huichu-huichu*, the *Huaturus*, the *Aceite de María*, and the *Campadre de Calisaya*.

31. These, with a few *Cascarilla carua* and *Cinchona* (var. *Huinapu*) form the upper shade of the ridge of rocks; below there is an undergrowth of ferns, colocasiæ, and moss. In different parts of this ridge of rocks 124 young *Calisaya* plants were collected, all growing out of the moss, which covered the rock to a thickness of from eight inches to a foot, in company with a few beautiful
hymenophyllums

* *Cascarilla carua*. *Lasionema cinchonoides*. *Gomphosia chlorantha*.

hymenophyllums and other ferns. There was scarcely any soil, the roots spreading along the face of the rock, which is a clay slate, easily broken up into thin layers by the growth of the plants.

32. Having entirely exhausted the provisions, it became necessary to retreat upon Gironda's clearing, a distance of 30 miles, and the delicate operation of packing the plants, which had previously been deposited in damp moss under the trees, was commenced on May 6th. A Russia mat was cut in half, to form two bundles, and the plants, the longest of which was cut down to a length of 18 inches, were carefully packed in rows, on layers of rich damp moss, which was very abundant.

33. I had made two attempts to ford the river, which was much swollen, and rushing along with great violence; but both times, after wading in up to my middle, the fury of the stream obliged me to return.

34. On May 7th we started in pouring rain, being entirely without food, and devoted some time to the search for calisaya plants on the slippery sides of the magnificent precipice of "Ccasa-sani," where I collected 21.

35. I was on the banks of the Yana-mayu river from the 2d to the 7th of May, during which time the thermometer ranged between 75° and 70° at 3 p. m., and the coldest at night was 58°. It rained more or less every day, generally from a few hours after sunset until 10 a. m., when it cleared up; but on the 7th it rained all day.

36. Returning to Gironda's clearing, I formed a second encampment at a place called "Lenco-huayccu," on May 8th, intending to explore the forests in the neighbourhood.

37. Although in this ravine the calisayas seem to prefer very shallow poor soils, in rocky situations, they certainly could never attain to their largest growth without more and richer soil. If the experiment proves successful in India, it will probably be found advisable eventually to form the calisaya plantations on slopes where there is shade and moisture, but some rich soil, so as to enable the roots to increase to their fullest size, and the trees to attain their largest growth. Very humid or flat situations, especially near the banks of rivers, must always, however, be carefully avoided. The plants might first be placed under the shade of trees, which, when they began to interfere with the growth of the calisayas, could be destroyed. The calisayas which I saw seemed to propagate themselves to a great extent by throwing out numerous roots from the branches, in the same way as the vine.

Cinchona Calisaya, var. Morada (Cinchona Boliviana of Weddell).

38. This species is made distinct from the *Calisaya* (var. *a Vera*) by Dr. Weddell in his work, but in a letter to me, dated 20th September 1859, he says that, in his present opinion, it is hardly more than a variety of the calisaya, its bark being very generally collected and sold as that of the latter. He adds that it is not met with in Tambopata, but only in Bolivia, and in the valley of Ayapata, in Caravaya. I, however, found and collected it in great abundance in various parts of the valley of Tambopata. The bark collectors consider it equal to the other variety of calisaya.

39. On 8th May I searched the heights of Tambopata, and found a number of plants of the *Calisaya morada* growing out of moss amongst the rocks, with hardly any soil, and on the 9th I resolved to make a third attempt to cross the river and examine the forests on the right bank. The river was 40 yards broad, and rushing with great fury over the ford, but we succeeded in crossing it without accident. The day's work began by a very precipitous ascent through the dense forest for about 400 feet, when we reached a rocky ridge, and rapidly collected 109 good plants of the *Calisaya morada*. This variety appears to prefer a little more shade and a little more soil (or, rather, holding ground, for it is entirely composed of moss and decayed leaves), than the *Calisaya, var. a Vera* of Weddell. It grows in the same rocky situations, with the roots sometimes actually in the crevices of the rocks.

40. I should add, that the *Calisaya morada* has been chiefly met with in

the upper part of the ravine, while the *Calisaya* var. *a Vera*, was almost entirely collected near the Yana-mayu, and several leagues lower down the course of the Tambopata river.

41. On the 11th I went to see a plant of the *Calisaya morada*, which had been planted in a small clearing, in order to obtain some particulars respecting its growth. I was told that it was planted in January 1859, from a root shoot less than a foot high. It is now 7 feet high, $6\frac{1}{10}$ ths inches in circumference round the trunk near the ground, and 3 feet 3 inches across the longest branches, from one side of the stem to the other. It was growing on the side of a steep hill, open to the south and east, at the edge of a clearing, whilst forest-covered mountains rose up close behind it to a great height. The soil consisted of a yellowish brown loam, composed of the disintegration of the rock, mixed with decomposed vegetable matter.

42. These details respecting the transplantation of a calisaya were all that I was able to procure, beyond the statement of Dr. Weddell, that a calisaya planted as a specimen in Tambopata (now cut down) had a trunk two inches thick in 1847, when it was ten years old.*

43. When planted in a richer soil in India, however, the calisayas will doubtless rapidly attain a growth equal to the largest of those in the Bolivian forests.

Cinchona Calisaya, var. *Verde*.

44. The bark collectors and other natives assured me that there are three kinds of calisayas, namely, the *Calisaya amarilla* or *Fina* (a *Vera* of Weddell), the *Calisaya morada* (*C. Boliviana* of Weddell), and the *Calisaya verde*, or *alta*, or *blanca*, not mentioned, as far as I am aware, by any author. They say that the latter is a very large tree, generally growing very far down the valleys, and in much lower situations than the other varieties. The veins of the leaves are never purple, but always a pale green, hence the name. The guide Martinez had cut a tree of this variety yielding six or seven cwts. of bark, including *canuto* or bark from the branches; and Gironda had seen a tree in the province of Muncas, in Bolivia, which yielded 10 cwts. of *tabla* or trunk bark alone. The true *Calisaya* of Weddell only yields three or four cwts.

45. I was very anxious to obtain plants of a variety which is said to attain so large a growth, and fortunately met with two, which happened to be growing on the heights of Tambopata.

Cinchona ovata, var. β *rufinervis*, var. *a vulgaris*.

46. I was particularly recommended by Dr. Weddell and Mr. Howard to procure some plants of the above species of cinchonæ, which grow at much greater elevations than the calisayas, and I devoted two days to a very laborious search for them, which was rather unsuccessful, though not entirely without result.

47. On the 5th of May I started with this object in view to examine the forest-clad heights of Pacchani, high above the hills over the Yana-mayu, and further to the north. After an ascent of 600 feet, high over the calisaya region, we came to trees of the *Pimentelia gomphosia*, with its bright laurel-like leaves and minute capsules, the *Cinchona pubescens*, and the *Cinchona ovata* (var. *a vulgaris*). The whole day was devoted to a difficult and wearisome search for young plants, but we only found three root shoots, two of the *a vulgaris* and one of the β *rufinervis*.

48. On the 10th of May I passed another day in searching for plants of the *Ovata* species, on some heights called Gloria-pata, immediately above Gironda's clearing. Trees were met with of both varieties, but very few seedlings or root shoots. The *Cinchona ovata*, though at a great elevation, inhabits the very moist parts of the forests, where the trees are covered with dripping moss and hymenophyllums, the latter a sure sign of extreme humidity. They were also in
a greater

* Letter to me, September 20th, 1859.

a greater depth of decaying leaves than the calisayas, but little or no apparent soil; and there was much more shade, tree-ferns and palms growing round them. In the zone just below grows the *C. pubescens*, and just above the *C. amygdalifolia* and *Cascarilla bullata*.

49. Altogether 25 plants of the *C. ovata* have been collected, nine of the variety α *Vulgaris*, and 16 of β *Rufinervis*.

Cinchona micrantha (*C. Affinis* of Weddell).

50. This species of cinchona is called by the natives *Motosolo* and *Verde paltaya*. It grows in very low, damp situations, near the banks of streams. I saw one tree, laden with bunches of deliciously sweet small white flowers, actually drooping over the waters of the river Tambopata. Dr. Weddell informs me that the *C. micrantha* sometimes produces a good quality of bark.

Letter to me,
August 10th, 1859.

51. The *C. micrantha* is found in company with many kinds of palms, tree ferns, bamboos, melastomaceæ, paccays (*Mimosa inga**), *C. pubescens* (var. *Huinapu*), and a *Lasionema*, called by the natives *Carhua-carhua blanca*,† (and apparently different from the *Lasionema cinchonoides* of Weddell,) which is very abundant along the banks of the river Tambopata. Seven good plants of the *C. micrantha* were collected.

GENERAL RESULTS.

52. By the 10th of May the collection was sufficiently large to fill the 15 Wardian cases which were provided for its reception at the port of Islay. We had procured 529 cinchona plants, more or less promising, namely:—

<i>Cinchona</i> Calisaya var. α <i>Vera</i> of Weddell	-	-	-	237
<i>Cinchona</i> Calisaya morada, <i>C. Boliviana</i> of Weddell	-	-	-	183
<i>Cinchona</i> Calisaya, var. β <i>Josephiana</i> of Weddell	-	-	-	75
<i>Cinchona</i> Calisaya verde	-	-	-	2
<i>Cinchona</i> ovata var. α <i>Vulgaris</i> of Weddell	-	-	-	9
<i>Cinchona</i> ovata, var. β <i>Rufinervis</i> of Weddell	-	-	-	16
<i>Cinchona</i> micrantha, <i>C. affinis</i> of Weddell	-	-	-	7
				529

53. The plants collected at the Yana-mayu encampment were conveyed in two bundles on the backs of Indians to Lenco-huayccu on the 7th and 8th of May, and again deposited under the shade of trees, with their roots in damp moss, together with the additional plants collected during the days devoted to searches in the forests near Lenco-huayccu.

54. On the 11th of May the collection of plants was prepared for the long journey across the Cordilleras. The plants were placed in rows, with thick layers of damp moss between them, and sewn up in Russia matting, forming four

* Ruiz y Pavon.

† *Carhua-carhua blanca*.—This tree appears to resemble closely the *Lasionema Cinchonoides* of Weddell, who says that its native name is "*Cascarilla Bruta*;" but the guide, Martinez, says that this plant is not the same.

Tree 30 to 40 feet high, growing in moist parts of the valley of Tambopata, near the banks of streams.

Bark lightish brown, marked with white lichens and mosses.

Leaves upwards of eighteen inches long and six to seven broad; dark green above; lighter beneath; veins extending very regularly from the mid-rib, oppositely or alternately pinnated; veins and mid-rib nearly white, especially on the under side; smooth; oblong, acute at both ends; coarse, often bulging between the veins and wrinkled.

Panicles corymbose and multiflower; in threes, and threes again; six to eighteen buds on each branch.

Calyx deep purple and green, leathery; five teeth, very rounded and blunt; limb deciduous; tube connate with the ovary; purplish.

Corolla.—Tube white, tinged with light purple; leathery; five laciniae, smooth and reflexed.

Stamens five, attached to the middle of the tube of the corolla; exserted; filaments pillose at the base; tinged with purple; anthers a little shorter than filaments, all lying over on the lower side of the flower; bivalve and opening towards the front; light brown colour.

Pistil light green colour; style exserted, but a little shorter than the stamens; stigma bicleft; length of tube of corolla to the end of the anthers, one inch.

four bundles, which measured 2 feet 6 inches by 2 feet. They were marked Nos. 1, 2, 3, and 4—

Nos. 1 and 2 containing *C. Calisaya*, vars. α and β .

No. 3 „ chiefly *C. calisaya morada*.

No. 4 „ some *Calisaya morada*, two *C. Calisaya verde*,
C. ovatas, and *C. micranthas*.

55. Specimens of rock were collected and marked, in all the localities where cinchona plants were met with. I considered it unimportant to bring away soil, as it appeared to be merely the disintegration of the rock, and the cinchonæ, growing chiefly in moss, seemed to be quite independent of it.

56. All the leaves of the *Calisaya* trees were more or less eaten by caterpillars, and the roots, especially of the young plants, were frequently attacked by the larva of a beetle, which bored holes through them. When this happened, it was observable that the plant began to throw out roots just above where the larva had deposited itself. I collected three specimens of the caterpillar on the leaves, and one of the animal in the roots, and preserved them in spirits.

THE VALLEY OF TAMBOPATA.

57. The whole of the cinchonæ, with the exception of the *Josephiana* variety of *calisayas*, have been collected in the valley of Tambopata, and I, therefore, endeavoured to collect as much information as possible respecting the soil and climate of that locality.

58. The river Tambopata rises at a place called Saqui, at the foot of the ridge dividing Peru from Bolivia, and, after a course of 20 leagues through a forest-covered ravine, the sides of which rise up abruptly and end in lofty mountain peaks, unites with another river called Pablo-bamba, or San Cristobal, which flows from the other side of the Cordillera of Saqui. The united streams form an important river, which enters the plain country to the eastward, and finally falls into the great river Ynambari or Purus.

59. The sides of the ravine of Tambopata are composed of a rock, which I believe to be a yellow clay slate. When exposed to the weather, it quickly turns to a sticky yellow mud, while below the surface it is very brittle, and easily breaks off in thin layers. Veins of white quartz runs through it, and, as in all the other valleys of Caravaya, gold is found in the bed of the river.

60. The height of the ravine of Tambopata above the level of the sea is between 3,000 and 4,000 feet, and I collected the following information respecting the climate from the natives:—

January.—Incessant rains, with damp close heat both day and night. No sun. Fruits ripen. *C. pubescens* (var. *Huinapu*) in flower.

February.—Weather as in January. Coca harvest. *C. calisaya* in flower.

March.—Less rain, hot close days and nights. Little sun. Bananas ripe. *C. calisaya* and *Pimentelia* in flower.

April.—Less rain, with hot humid nights, and little sun during the day. *C. micrantha* in flower.

May.—A showery month, with little heavy rain. From May 1st to 12th the thermometer ranged from 62 degrees to 71 degrees at 7 A.M., from 69 degrees to 75 degrees at 3 P.M., and from 58 degrees to 68 degrees, the minimum, at night. The trade wind coming up the ravine brought clouds and rain. Month for planting coca and sugar-cane, and what is called the *michca*, or small sowing of maize. Edible roots sown. Coffee harvest begins. *C. micrantha*, *C. amygdalifolia*, *C. pubescens*, *Cascarillas Carua* and *Bullata*, *Gomphosia*, and *Lasionema* in flower.

June.—Dry and very hot month. Much sun and little rain. A good time for sowing edible roots. A coca harvest early in the month. Oranges and paccays ripen. Cool nights, but a fierce heat during the day.

July.—The driest and hottest month, with cool clear nights. Very few showers. Time for sowing pumpkins, gourds, and water-melons. *C. ovata* flowers.

August.—Generally dry, trees begin to blossom. A month for planting. Bean harvest. *C. Calisaya*, *Pimentelia*, and *Gomphosia* ripen.

September.

September.—Rains begin. Coca harvest. Time for the blossoming of many trees.

October.—Rains increasing. Paltas ripen. Maize harvest, and time for sowing the *sembra grande* of maize. *C. micrantha*, *C. pubescens*, *C. amygdalifolia*, *Cascarillas Carua* and *bullata*, and *Lasionema* ripen.

November.—Heavy rains. Coca harvest.

December.—Heavy rains. Pumpkins and gourds ripen. *C. ovatas* ripen.

61. Edible roots yield a year after planting, sugar-cane in two years, maize and beans in six months, coca gives three harvests of leaves a year.

62. Almost the whole of the ravine is one huge virgin forest, clothing the sides from the banks of the river to the summits of the mountain peaks. There are a few small clearings in the upper part of the ravine, the produce of which supports the inhabitants, about 20 souls.

DIFFICULTIES WITH THE NATIVES.

63. With regard to the Indians who carried the provisions and plants, they were very suspicious and expected ill-treatment. On two occasions, they had resolved on deserting me and returning to their homes, in which case the failure of the enterprise must have followed. My knowledge of the Quichua language, and of the habits and feelings of the Indians, alone enabled me to manage them, and retain them in my service during a period of perilous and very laborious work.

64. But the principal difficulties arose from the obstacles which the petty local authorities attempted to throw in my way. Señor Gironda, who had been very friendly and had assisted me in various ways, was a justice of the peace, and the only authority in the ravine. On the 11th of May, just after the plants had been sewn up ready for their journey, a letter to Gironda arrived from Don José Bobadilla, the alcalde municipal of the district of Quiaca, saying that he had received positive intelligence that an English stranger had entered the forests to collect cinchona plants, to the serious injury of the people of this country, and ordering Gironda not to permit me to take a single plant, and to send me and the man who had assisted me as prisoners to Quiaca. The rest of the letter, which is in very bad Spanish, relates to other business.* I had reason to believe that a busy, meddling Peruvian, named Don Manuel Martel, had stirred up this opposition, and my opinion was confirmed when I heard that his son was the bearer of the letter. Gironda, though civil and obliging, was very anxious to throw all the plants away, in obedience to his instructions, and I found it necessary to make a rapid retreat, in order to save them.

65. Next day, just before starting, I heard that the ignorant people of Quiaca had been stirred up against me by Martel and Bobadilla, and that they were sending a party down the valley to seize the plants. This news hastened my departure, but I met with other obstacles at Sandia, chiefly caused by the machinations of the same Martel, which gave me considerable trouble. These annoyances obliged me to make a rapid journey, with the plants, direct to Arequipa, without entering any town or village whatever, while the gardener went round by Crucero to get my luggage. This resolution was fortunate, as the gardener found Martel awaiting my arrival at Crucero with the plants, in order to lodge a complaint against their extraction with the Sub-Prefect.

66. Some

* Copy.

"Al Señor Juen de Paz,

"Don Juan de la Cruz Gironda.

"6° de Mayo de 1860.

"Teniendo positivas noticias de que sea internado a los puntos de Tambopata un extranjero Ingles, con objeto de extraer plantas de cascarilla, me es de absoluta necesidad pasarle a vm. esta nota para que sin permitir que, en grave perjuicio de los hijos del pais, lo tome ni una planta, por lo que como autoridad debe vm. de aberiguar bien para capturar a el y a la persona quien se propone a facilitarle las dichas plantas, y conducirlo a este; por consiguiente comunico a vm. que por su ausencia sean demorado varios decretos superiores de la capital por lo que debe vm. restituirse lo mas pronto posible.

Dios guarde a vm.,
(signed) José Mariano Bobadilla,
"Alcalde Municipal del Distrito de Quiaca."

66. Some knowledge and experience of the people with whom I had to deal, and a succession of very fortunate accidents, alone enabled me to overcome these obstacles, which, for some time, threatened the complete failure of the enterprise; and it would certainly be useless to attempt to enter this province for a similar object, at least for some time to come.

RAPID JOURNEY WITH THE PLANTS FROM THE FORESTS TO THE PORT OF ISLAY.

67. On the 19th of May, I left the ravine of Tambopata with the plants, and reached Sandia on the 15th. In passing through a forest in the road, one of the mules fell down a precipice for 20 feet, the fall being broken by dense under-wood, and more than two hours was occupied in cutting trees and brushwood down to clear a way for him to get out.

68. At Sandia I found great difficulty, and met with much hindrance in procuring the means of proceeding on my journey; but at length I obtained two mules for the plants and an Indian to assist me to load them, and I resolved to make my way direct across the Cordillera, without entering any town or village, to a place called Vilque, where a great fair was going on, and whence I could hire mules to Arequipa. The gardener was sent round by Crucero to pick up my luggage.

69. Since leaving Sandia on April 24th up to May 15th, we had walked over 174 miles, which may not, at first sight, appear very much; but when it is considered that it was chiefly not walking, but scrambling on hands and knees up precipices or through dense forests, and that there was not one day given up to rest, while the supply of food was exceedingly small and precarious, I think it will be considered tolerably good work.

70. On the 17th of May I left Sandia with one Indian and two mules carrying the plants, and halted under a splendid range of frowning black cliffs near the summit of the snowy Carabaya range. On the 18th I reached the summit of the range, and commenced the journey over vast grass-covered plains covered with stiff white frost; after being 11 hours in the saddle, I stopped at an abandoned shepherd's hut built of loose stones. The plants, well covered with the tent and blankets,* were placed by my side during the night, with the thermometer between us, which at 6 a.m. was at 20 degrees, the days and nights bitterly cold, but very fine and generally cloudless. On the 19th I was ten hours in the saddle, and passed the night again in an abandoned hut with the plants beside me, where the minimum of the thermometer was 30 degrees. Two more journeys of similar length, when the minimum during the night of the 21st was 21 degrees, and of the 22d, 16 degrees, brought me to Vilque, where I procured an arriero and mules to convey me to Arequipa. The sufferings during my six days' journey over the lofty plains from Sandia to Vilque were very great; the cold was intense, the work I had with the vicious unmanageable mules was a constant source of anxiety, and I had no food whatever beyond a little parched maize; each day I was upwards of 10 hours in the saddle.

71. Leaving Vilque on the 24th, by forced and rapid marches over an uninhabited and frozen tract of country, exposed to furious gales of intensely cold† wind, I reached the city of Arequipa on the 27th, having travelled over 350 miles of difficult country in 10 days, having to accommodate myself to the pace of a walking Indian and pass much of the time in chasing the vicious mules; I was never less than 10 hours in the saddle.

72. At Arequipa I found the moss which enveloped the plants still damp; but I watered them once or twice during my stay there between the 28th and 30th, during which time the range of the thermometer day and night was between 56 and 60 degrees. On the 31st, I left Arequipa, and crossing the desert, the plants were safely deposited beside the Wardian cases at Islay on June 1st. The gardener arrived at Arequipa on May 29th.

ESTABLISHMENT

* Before leaving Sandia, an extra Russia matting was sewn over each bundle of plants.

† From Vilque to Arequipa the minima of the thermometer were—

On the 23d	-	-	-	-	26 degrees.	On the 26th	-	-	-	24 degrees.
" 24th	-	-	-	-	23 "	" 27th	-	-	-	36 "
" 25th	-	-	-	-	24 "	" 28th	-	-	-	56, at Arequipa.

ESTABLISHMENT OF THE PLANTS IN THE WARDIAN CASES.

73. Having written to Mr. Wilthew, Her Majesty's Consul at Islay, immediately on my arrival at Arequipa, he had kindly caused the Wardian cases to be placed in the yard of an English carpenter, and had procured a supply of good soil from the ravine of Mataranes, at the same spot whence I sent a sample for analysis with my letter to Dr. Forbes Watson (No. 2).

74. The plants, which were found on the whole to be in a favourable state, were planted in the cases and well watered during the 2d and 3d of June. The cases being numbered from 1 to 15, a rough account was kept of what plants were deposited in each, some in the flower-pots which had just arrived from England, and those with larger roots loose in the soil.

75. The large-rooted plants without any foliage are in cases, with moss covering the soil, so as to supply them with more moisture. The contents of the Wardian cases are as follows :—

No. 1.	Calisayas (<i>var. β Josephiana</i>) in pots	-	-	-	50
„ 2.	Calisayas (<i>var. α 16 and β 25</i>)	-	-	-	41
„ 3.	Calisayas (<i>α</i>)	-	-	-	34
„ 4.	Calisaya Moradas (<i>C. Boliviana</i> of Weddell)	-	-	-	38
„ 5.	Calisaya Moradas, in pots	-	-	-	42
„ 6.	Calisaya Moradas 14 (<i>C. micrantha</i> ; 1 large <i>C. ovatas</i>)	-	-	-	15
„ 7.	Calisaya Moradas (and the 2 <i>Verdes</i> , large, <i>C. ovatas</i>)	-	-	-	18
„ 8.	Calisaya Moradas (2 <i>C. ovatas</i> , &c., in pots, <i>C. micranthas</i> 4)	-	-	-	49
„ 9.	Calisaya (<i>α</i>) in pots	-	-	-	28
„ 10.	Calisaya Moradas	-	-	-	32
„ 11.	Calisayas (<i>α</i>)	-	-	-	32
„ 12.	Calisayas (<i>α</i>) and Moradas, unpromising	-	-	-	15
„ 13.	Calisaya Moradas, small and good	-	-	-	32
„ 14.	Calisayas (<i>α</i>) large	-	-	-	15
„ 15.	Calisaya Moradas (<i>C. ovatas</i> , &c.)	-	-	-	15
					456
Plants killed by the cold of the Cordilleras, broken on the journey, or lost					73
					529

76. The flower-pots, most of which were broken on the voyage, are of two sizes, No. 40 and No. 60. The plants will be watered every day and carefully attended to until the day before shipment, when the soil will be battened down and sashes screwed on; in the meanwhile they are kept screwed down, so as to create an artificial atmosphere after being watered, and screened from the heat of the sun at midday. Islay is always exceedingly dry, but June is, on the whole, a favourable cloudy month, thermometer ranging between 64 and 74 degrees.

SEEDS.

77. It was my intention to have returned to the forests of Tambopata for seeds of the *C. calisaya* towards the end of July or the beginning of August; but the opposition I afterwards met with convinced me that any attempt to make the collection personally would be worse than useless. Generally speaking, I have no confidence in native agency; nevertheless, under these circumstances, I have thought it my duty to make several arrangements for procuring a supply of calisaya seeds, which, if they fail, will cause no expense, and, if successful, will require an outlay of about 50*l*. I have good grounds for believing that a supply of several thousand seeds will be forthcoming, but all dealings with natives are uncertain.

EMPLOYMENT OF MR. PRITCHETT IN HUANUCO.

78. The Secretary of State having shown his sense of the importance of obtaining as many different species of the cinchona plant as possible, for introduction into India, by authorising me to expend 500*l*. additional, in procuring

plants or seeds from the forests of Huanuco and Huamalies, I have succeeded in procuring the services of a Mr. Pritchett for that purpose. While at Guayaquil, I received a very favourable report of the character and qualifications of that gentleman from Mr. Cope, Her Majesty's Consul General in the Ecuador, and I resolved to employ him, in the event of his coming out to these countries.

79. Mr. Pritchett arrived in Lima on the 10th of April, and was at once supplied with funds to enable him to start for the forests, together with a paper of instructions respecting the species of cinchona plants which are found in Huanuco and Huamalies, with some notes on the mode of collection.

80. During my short stay in Lima, I shall endeavour to have some Wardian cases made for his plants; but I shall, at the same time, instruct him to turn his attention chiefly to the collection of seeds. I trust that, by September, he will have been enabled to collect a good supply of the species found in the Huanuco region, which are so well known to botanists through the work of Ruiz and Pavon, and the accounts given by Poëppig.

CONVEYANCE OF THE PLANTS TO INDIA.

81. After some consideration, the gardener and I have decided that it will be best to give the plants some time to establish their roots in the flower-pots and cases, previous to their embarkation. I shall, therefore, proceed with them to England by the steamer which passes Islay on the 25th of this month, and expect to arrive at Southampton on the last day in July. The monsoon is not over in the Neilgherry hills, I believe, until the end of September; and it may, therefore, be thought advisable to wait between two mails at Southampton during the warm month of August, but this question will be decided in England.

82. I, of course, propose to accompany my collections to their final home in the Neilgherry hills, as it is very important that I should examine the sites prepared for their reception, or proposed to be used for their future culture, and thus be enabled to supply Dr. Cleghorn and others with all the information I possess. I should also be on the spot when the collections of Mr. Spruce and Mr. Pritchett arrive.

83. John Weir, the gardener, who has accompanied me, has been very efficient in his special duties of packing the plants and establishing them in the Wardian cases, and has displayed much zeal and interest in the enterprise, during the period of his service. I consider him fully entitled to the extra 60 *l.* a year, the receipt of which was to depend on the report I was enabled to make of his conduct.

84. In addition to specimens of rocks and of the animals which feed on the cinchonæ, a collection of dried leaves, capsules, and flowers of the cinchonæ was made; but, owing to the excessive humidity and continual rains, and the impossibility of devoting sufficient time and attention to them, they are in a very damaged state. Specimens of bark, and small branches of cinchonæ and allied species, with their *canuto* bark, were also collected in the forests.

85. Trusting that the numerous deficiencies of this Report will be excused, in consideration of the weak and exhausted state in which I arrived here, and the short time I have had to write it before the arrival of the steamer, while much occupied with other duties connected with the establishment of the plants in the cases,

I have, &c.
(signed) *Clements R. Markham.*

— No. 35. —

From *E. D. Bourdillon*, Esq., to *Clements Markham*, Esq.

Sir,

India Office, E. C., 26 April 1860.

I AM directed by the Secretary of State for India in Council, to request that you will despatch to the Governors of Jamaica and Trinidad any small quantity of seeds of the cinchona plant, which may be available for that purpose, without detriment to the supply you may be able to procure for transmission to India, Ceylon, and the Royal Gardens at Kew.

Clements Markham, Esq.,
&c. &c. &c.

I am, &c.
(signed) *E. D. Bourdillon*.

— No. 36. —

From *Herman Merivale*, Esq., to *Clements Markham*, Esq.

[Note.—This letter was not received by Mr. Markham until after his return to England.]

Sir,

India Office, E. C., 17 May 1860.

YOUR letter, dated 20th March last, detailing your past proceedings, and your future plans in execution of the commission with which you have been entrusted, has been read by the Secretary of State in Council with much interest; and I am directed in reply to state, that in the embarrassing position in which you were placed in consequence of the local information you obtained regarding the position of the *Cinchona Calisaya*, and the obstacles to procuring plants and seeds of that species from Bolivia, Sir Charles Wood is fully satisfied that you exercised a sound judgment as to the course which you decided to follow.

With regard to the mode of transporting your collections to India, Sir Charles Wood has already given you full authority to avail yourself of any opportunity which may be afforded for the transport of the seeds and plants to India, either by sailing or steam ship. He is disposed to agree in the opinion which you have since expressed, that the chances of detention on a sailing vessel, render it inexpedient to select that mode of conveyance. He has, in accordance with your former request, taken the requisite steps for securing the safety of your collections, should you decide on dispatching them *via* Panama and Southampton; but he wishes you to understand, that if it should be in your power to charter a steamer direct to India, you are at liberty to make arrangements for that purpose, should you still deem it desirable.

The Secretary of State in Council fully appreciates the difficulties and dangers which you must necessarily encounter in the progress of your arduous mission. He has full confidence in the zeal, energy, and sagacity with which you will meet the obstacles in your way; and he trusts that, notwithstanding opposition, you will return to this country in health and safety, to enjoy the satisfaction of the successful result of your labours.

Clements R. Markham, Esq.
&c. &c. &c.

I am, &c.
(signed) *Herman Merivale*.

— No. 37. —

EXTRACT from *Clements Markham*, Esq., to the Under Secretary of State for India.

Sir,

Steam-ship "Atrato," 28 July 1860.

IN continuation of my letter, dated 9th June 1860, I have the honour to report, for the information of the Secretary of State for India in Council, that I have arrived at Southampton, on board the steam-ship "Atrato," with the Wardian cases, containing my collection of cinchona plants, this day.

2. After the despatch of my letter, dated 9th June, I encountered very considerable difficulty in embarking the plants, owing to the obstacles thrown in my way by the local authorities. Mr. Wilthew, Her Majesty's Consul at Islay, to whom I am much indebted for advice and active assistance, has written a report

of the difficulties I have encountered in the embarkation of the plants, in a despatch to the Foreign Office, by this mail.

3. Before leaving Lima, I despatched two letters to Mr. Pritchett in Huanuco, containing instructions for his guidance, and I have ordered a carpenter at Lima to make six Wardian cases for the reception of his plants.

4. The last tidings I have received from Mr. Spruce are, that he has hired the forests below Huaranda, on the western slope of Chimborazo, where the best red bark is procured, and that he intends to embark his collection on rafts at Ventanas, some way up the river Babahoyo. The forests producing *C. Condaminea* are 15 days' journey from those of Huaranda, and he proposes to send a Dr. Taylor of Riobamba to Loxa, to procure plants and seeds of that species.

5. With reference to Mr. Bourdillon's letter to me, dated 26th April 1860, I have directed Mr. Spruce and Mr. Pritchett to make up two small parcels of cinchona seeds, in case they obtain a sufficient supply, addressed to the Governors of Jamaica and Trinidad, to the care of Her Majesty's Consul at Panama. The gardener, Cross, has passed through Panama, on his way to Guayaquil.

6. The plants are, on the whole, in a good condition, and upwards of 210 are throwing out shoots.

7. I enclose two sketch maps, showing my journey to the cinchona forests of Carabaya, hastily drawn from data, for the construction of maps, consisting of a fixed position at Crucero, and a series of bearings and cross bearings, with a true bearing taken at intervals. These maps should have accompanied my report, dated 9th June 1860.

I have, &c.
(signed) *Clements R. Markham.*

— No. 38. —

From *J. Murray, Esq.*, to *T. G. Baring, Esq., M.P.*

Sir,

Foreign Office, 20 August 1860.

WITH reference to your letter of the 29th of April 1859, I am directed by Lord John Russell to transmit to you, to be laid before Secretary Sir Charles Wood, a copy of a despatch from Her Majesty's Consul at Islay, reporting the success of Mr. Markham's mission, and his departure for England with specimens of the cinchona plants.

I am, &c.
(signed) *James Murray.*

T. Baring, Esq., &c. &c. &c.
India Office.

Enclosure in No. 38.

From Her Majesty's Consul at Islay, to Lord *John Russell.*

My Lord,

Islay, 24 June 1860.

IN reference to a despatch from the Foreign Office, under date of the 30th of April last, I have the honour to inform your Lordship, that I have done all in my power to assist Mr. Markham in the fulfilment of his mission. Mr. Markham leaves this to day, in the steamer, direct for England, *via* Panama, taking with him 460 cinchona plants of the *calisaya*, or best of the species, well secured in Wardian cases, hermetically sealed.

The plants have been allowed to remain here more than a fortnight to repose, and I have had an opportunity of observing during that time how they have thrived, the sprouts, or growth, being very evident in most of them.

The plants were brought down from the interior by Mr. Markham, accompanied by a gardener, wrapped up in matting, in which was a quantity of moss and fern to preserve the dampness; most of them have been planted separately in small flower-pots, the pots embedded in the soil, and battens placed across each row; to prevent their moving, others have been planted in the cases.

Mr. Markham had had many hardships to pass and difficulties to contend with, in procuring the plants. He was for more than ten days in the Montana or forest of Carabaya, which forms the frontier of Peru and Bolivia, accompanied by four Indians, with very little to eat, being obliged to take the necessaries of life with him, and sleeping under a tent in a very damp atmosphere, and on damp soil.

On his return out of the Montana, an order arrived from one of the petty authorities to seize all the plants, as they were not allowed to be exported. By bribery and persuasion,
Mr. Markham



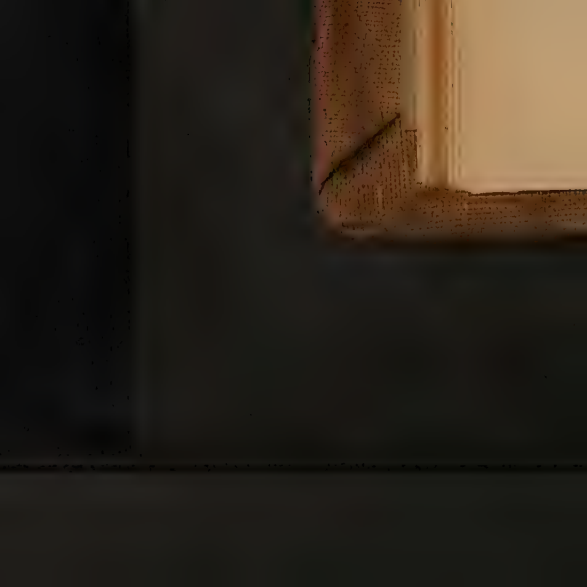
LA PAZ

Enclosure 1 to No 37.

SKETCH MAP
Shewing the Journey to the
CHINCHONA
Forests of Carabaya.
1860.

Clement Markham

Track of C.R.M.





Mr. Markham was able to make his escape with them, taking a cross road to avoid molestation, and so arrived safe at Arequipa.

At this port, again, the administrator of the Custom-house objected to the plants being exported, without an express order from the Government and Lima, and Mr. Markham was obliged to proceed to that city to obtain the necessary permission, which, after some scruples on the part of the Minister, he was fortunately able to succeed in doing.

I am not aware that any decree exists prohibiting the exportation of the Cinchona plant, and this molestation on the part of the authorities has proceeded from feelings of jealousy, and from an idea that it is robbing the country of one of its sources of wealth.

Mr. Markham has not been able to take with him any of the seeds, as they are not in a ripe state until the month of August.

I trust that the ultimate object of the Government in sending Mr. Markham on this mission may be obtained.

The Lord J. Russell.

I have, &c.
(signed) C. Wilthew.

— No. 39. —

From *Herman Merivale, Esq.*, to *Clements Markham, Esq.*

Sir,

India Office, E.C., 11 August 1860.

I AM directed by the Secretary of State for India in Council to acknowledge the receipt of your letters, dated 9th June and 28th ultimo, the former reporting your proceedings after arrival in Peru, in fulfilment of the Commission with which you were entrusted for obtaining seeds and plants of the Cinchona, and the latter detailing your subsequent proceedings up to your arrival at Southampton on the 28th ultimo, with your collection of plants.

Sir Charles Wood has perused with much interest the detail of your proceedings in Peru, and he directs me to assure you, that he highly appreciates the zeal, energy, and intelligence which have enabled you to form so considerable a collection of plants of the more valuable species of the Cinchonas, as well as to surmount the various difficulties which you had to encounter in the course of your enterprise, whether arising from the natural features of the country to be traversed, the peculiar character of the season, or the jealousy manifested by the population and by the officers of the Government when the object of your expedition became known.

There appears to Sir Charles Wood to be every reason to be satisfied with the measure of success which has attended your arduous enterprise; and your determination to leave the country with the plants, without waiting for the ripening of the seeds of the Cinchonas, is fully justified by the opposition which was subsequently offered to the object of your mission, and which, had your departure been deferred, would probably have led to its entire failure.

Sir Charles Wood is of opinion, that it is highly desirable that you should yourself accompany your collections to India, in order that the experience you have obtained of the situations peculiar to the various species of the Cinchonas may be turned to the greatest possible account, and the Peninsular and Oriental Company have already been requested to reserve accommodation for you on board the steamer leaving Southampton on the 20th instant.

The instructions given to Mr. Pritchett for his guidance in his search for Cinchona plants and seeds in the district of Huanuco have the approval of Sir Charles Wood, and the necessary communication has already been made to Messrs. Gibbs & Co., to make such advances as he may require to the amount which has already been sanctioned.

In conclusion, I have to state that Sir Charles Wood has pleasure in expressing his entire satisfaction with the manner in which you have discharged a duty of great public importance, which you voluntarily assumed when the attempts previously made to meet with a duly qualified person to undertake it had proved fruitless. He has noticed the economy with which your proceedings have been conducted, and he will be prepared, at the close of your labours, to take into favourable consideration your claim to remuneration for the successful performance of an arduous and useful service.

Clements R. Markham, Esq.
&c. &c. &c.

I am, &c.
(signed) *Herman Merivale.*

— No. 40. —

From Sir *C. Wood* to the Governor General of India.

My Lord, India Office, London, 17 August 1860.

MR. CLEMENTS MARKHAM, whom I sent on an expedition to the forests of Bolivia in order to procure plants and seeds of the quinine-yielding *Cinchona* tree, having successfully accomplished his mission, will leave England by the steamer of the 28th instant for Bombay, and thence proceed by sea to Calicut, with the plants in his charge. I transmit herewith, for your information, six copies of Mr. Markham's report of his proceedings while engaged in South America on this undertaking.

2. The Governments of Madras and Bombay have also been advised of Mr. Markham's departure for India by the steamer above mentioned.

His Excellency the Right Honourable
The Governor General of India in Council.

I have, &c.
(signed) *C. Wood.*

— No. 41. —

From *R. Spruce*, Esq., to the Under Secretary of State for India.

Sir,

Ambato, Republic of Ecuador,
12 March 1860.

YOUR letter of November 18, 1859, did not reach me until the end of last month, when we had been for a long time without any correspondence with Guayaquil, on account of the mails being detained by the hostile troops which occupied the road. It was, however, intimated to me some time ago by Mr. Markham that my services had been accepted by the India Government for the object of procuring seeds and plants of the valuable sorts of *Cinchona*, and I therefore, at the end of last year, laid aside every other occupation to make the necessary preparations for entering on that enterprise. I had besides, during last summer, spent over two months in the forests on the western flank of the Cordillera, at my own expense, and with the sole object of making myself acquainted with the different sorts of *Cinchona*.

I have now succeeded in hiring all the woods on the western side of Chimborazo (belonging to five different farms) for the purpose of getting out of them seeds and plants of the red bark (*Cascarilla roja*), which is of better quality there than elsewhere, and I hope to enter them in the month of May, when the rains begin to abate.

I am also in treaty with the owners of the woods near Loja which produce the *Cinchona Condaminea*, and hope to obtain license to enter those woods for my purpose. But here a difficulty arises, for, so far as I can make out, the *Cinchona Condaminea* has ripe seeds in the same month as the *Cascarilla roja* (namely, in July), and from Chimborazo to Loja takes 15 days, or if the traveller be overtaken by bad weather, or any of his beasts break down, he may spend 20 days or more on the way. It is therefore clearly impossible that I can be in both places so as to see with my own eyes the seeds of each species taken from the tree, which is the only way to be sure of having the right sort, for the seeds of all *Cinchonas* are so much alike that they cannot be distinguished without the leaves. To procure the *Cinchona Condaminea*, I should therefore have to send to Loja a competent person in my place, and employ a sufficient staff of labourers to get out the young plants and convey them to the coast; so that although the procuring of seeds and plants of the *Cascarilla roja* (and of some other kinds of less value which grow near it, in a cooler climate) may be accomplished for something less than the 500*l.* to which my expenses are in the first instance limited, it would considerably exceed that sum to procure the *Cinchona Condaminea* in like manner. As my instructions hardly give me plenary powers on this head, I have written to consult Mr. Cope, and shall be guided by his decision.

I shall

I shall throughout be as economical as possible, and render an exact account of my expenditure. I have horses of my own which I shall make use of as far as I can, and charge only for their keep. It must also be recollected that I am already on the spot, and that no expense is incurred by my coming out or returning.

I shall not fail to make careful observations on the climate and soil of the regions where the different kinds of *Cinchona* flourish, in accordance with your recommendation.

I remain, &c.
(signed) *Richard Spruce.*

— No. 42. —

From *R. Spruce, Esq.*, to *Clements Markham, Esq.*

Dear Sir,

Ambato, 14 April 1860.

I WROTE a letter to you on the 1st of March, but I learn that it has never reached Guayaquil. I write therefore again, and as the letter goes by the courier of the Corps Diplomatique in Quito, I trust it may safely reach your hands. We have for long had no certain communication with the coast, and I kept three beasts and a man waiting for six weeks to bring up. Cross the moment I should hear of his arrival at Guayaquil. The receipt of your letter of January 19th (which reached me three weeks ago) informed me that I must not expect him until May. At the same time I received the box you were so kind as to bring me from England, along with a portion of Mr. Howard's work on *Cinchona*, but the pamphlet you mention has not come to hand. What was it about? I was in hopes to receive by you Weddell's Monograph, as also the Report of the Dutch Government.

I have hired the forests below Guaranda, on the western slope of Chimborazo, where the best variety of the *Cascarilla roja* is procured. The port where I shall have to embark my collections (on rafts) is Ventanas, a good way up the river Babahoyo.

There is a difficulty about getting the *Cinchona Condaminea*, for the forests of Loja which produce it are 15 days' journey from those of Guaranda, and as both *Cinchonas* fruit at the same season (July), it is impossible that I can see seeds taken from both with my own eyes, which is the only way to be sure of having the right sort; I propose, therefore, sending Dr. James Taylor (of Riobamba) to Loja, and I have written to ask Mr. Cope if I may venture on this additional expense. Otherwise, I might, next year, gather seeds of it myself and send them to Kew, as I propose making a journey to Loja on my own account.

Your proposal about tying gauze bags round the corymbs of fruit might be good if there were any one "to bell the cat;" but who is to climb within reach of the ends of the brittle ramuli of the *Cascarilla roja*? My plan is, to spread sheets under the tree at the time of cutting or breaking off the branches with seeds.

Mr. Howard is all out about the climate of the *Cascarilla roja*. He has been misled by a worthless book, "*Geografia del Ecuador*," by one Manuel Villavicencio, which is as full of mistakes as it is of paragraphs.

I will do my best to carry out your instructions respecting the transmission of the *Cinchona* plants and seeds.

If you find it practicable to dry for me a specimen, with flower and fruit, of every sort of *Cinchona* you meet with, I shall be exceedingly obliged to you, and I will do the same for you if you desire it.

You must let me know the date of your going to Guayaquil, and I will endeavour to await your arrival there.

Trusting your life and health may be preserved, and that you may have as pleasant a time of it as can be expected in these rough countries,

I remain, &c.
(signed) *Richard Spruce.*

Clements R. Markham, Esq., Lima.

— No. 43. —

REPORT on Expedition to procure Seeds and Plants of *Cinchona succirubra*, or Red Bark Tree ; with Specimens for the Herbarium at Kew.From Mr. *Richard Spruce* to the Under Secretary of State for India.

Sir,

Guayaquil, 12 October 1860.

THE troubled state of this country, and the interruption of communication between the interior and the coast, have prevented my informing you until now of what I was doing towards carrying out the project of procuring *Cinchona* plants and seeds. The same causes have interfered seriously with its successful execution ; but as I trust that all obstacles have at length been overcome, I shall at present confine myself to a brief account of my operations, reserving for a future occasion a fuller Report, comprising all my observations on the site, meteorology, and accompanying vegetation of the tree producing the *Cascarilla roja*, or red bark.

At the beginning of the present year, I laid aside every other occupation to devote myself to the task assigned me. I had last visited (at my own expense) the *Cinchona* forests below Alansi, in order to make myself acquainted with the trees producing the barks of commerce ; but as I afterwards learnt that the red bark collected about the foot of Chimborazo fetched nearly double the price in the market of that brought from the forests of Alansi and Cuenca, I thought it my duty to endeavour to procure seeds, &c., from trees whose bark was considered the best, although to the eyes of a botanist specimens from all these localities might present no specific difference. The forests of Chimborazo (generally called "of Guaranda," though actually from one to four days' journey from that town) cover an area of perhaps 2,000 square miles. They are rented by two persons, for the purpose of getting out the bark they produce, and I immediately entered into treaty with those persons to allow me to collect as many seeds and young plants as I needed, during the present summer, or dry season. At first, they were unwilling to grant me such permission, at any price ; but after a good deal of correspondence, and travelling to and fro, I finally agreed with them that, on payment of 400 dollars, I might take from the forest all I required, provided I did not touch the bark.

It cost me no small amount of inquiry to ascertain what was the best point for a centre of operations, in a range of country so extensive, and accessible with such difficulty ; but I finally made out that a place called Limon, where there are a few small cane farms, at the junction of the river Limon with the larger river Chasúan (which is one of those that go to form the river of Guayaquil), was the place where the finest bark had been obtained, and that the settlers, since they found out the value of the bark, had preserved with great care such young trees as were standing on their farms.

I engaged eleven cascarilleros of Guanújo (a village adjacent to Guaranda, where most of the bark collectors reside) to enter the forest with me, as soon as the weather permitted, to search for trees and plants of *Cinchona*.

I also availed myself of your permission to secure the services of Dr. James Taylor, of Riobamba, for the purpose of procuring seeds and plants of the *Cinchona condaminea* from Loja.

In the spring, I was unfortunately taken seriously ill of a rheumatic and nervous affection, almost amounting to paralysis, which, although it did not incapacitate me from continuing the necessary preparations, rendered it doubtful that I should be able to bear the arduous fatigues of travelling in the forest ; I therefore concluded to resign my commission to Dr. Taylor, and send him for the red bark in my room.

The rains did not abate until the end of May, and the 5th of June was fixed on as the day of starting for the forest ; for which purpose Dr. Taylor went over to Ambato, where I was residing. Encouraged by his assurance that, if I could only get over to Chimborazo, the climate of the warm forest might probably restore me, and after using for a few days such remedies as he suggested, I started in his company on the 11th of June, my idea being that if I soon get well enough to conduct the enterprise alone, I might then despatch Dr. Taylor to Loja. In the pass of Chimborazo, I was so much exhausted that I had to remain two nights and a day in a hut at a height of nearly 13,000 feet. I rallied, however, and was enabled to reach Guaranda, where I found that my cascarilleros had all been
taken

taken as soldiers or militiamen. I remained some days in the vain attempt to procure license for them to proceed to the forest, which was promised me only when the country should be freed of its "tyrants." In their room, I thought myself fortunate in securing four Indians to work under my directions, although they were quite incapable of acting as guides to localities which had remained unsearched in previous years, and to explore which would need excursions into the forest of 10 or 15 days, under the guidance of practised *cascarilleros*.

At Guaranda, I learnt for the first time (by the passing of diplomatic correspondence for the Honourable C. R. Buckalew, American Minister at Quito) that Mr. Cross, the gardener destined by the India Government to take charge of the *Cinchona* plants, had arrived at Guayaquil, about the middle of May; and, by the passing of the Spanish Minister through Guaranda for Guayaquil, I was fortunately enabled to write to Mr. Mocatta, Her Britannic Majesty's Consul at Guayaquil, requesting him to forward Mr. Cross to Ventanas, which is the port on the river of Guayaquil where we must embark our collections made at Limon. Such rare opportunities were now my only means of communication with Guayaquil, and I had not another for above three months afterwards.

On the 17th and 18th of June, we descended from Guaranda, by a most precipitous and dangerous track, to Limon,* where we established ourselves in the rancho of one of the settlers. Having reposed a day, Dr. Taylor proceeded to Ventanas—other two days' journey—to await the arrival of Mr. Cross.

After having been a few days at Limon, I so far recovered the use of my limbs as to be able to move about—partly on foot, partly on horseback—and ascertain, by a personal examination, everything which was necessary to be known. I was well satisfied to see, standing about in the cane-fields and near the houses, several fine young trees of the *Cinchona succirubra*, from 30 to 50 feet high, and, as far as I could ascertain, from 13 to 15 years old. Many of them had flowered freely this year, and on several the capsules had attained nearly their full size. They also bore signs of having fruited last year, but no young plants existed beneath them, which was explained by their either standing among cane which had been frequently weeded during the year, or else in open places where cattle had grazed and trodden about. The seedling plants, which I had been assured at Guaranda might be had in any quantity at Limon, proved to be all either shoots from old stools of *Cinchona succirubra*, or young plants and suckers of the worthless *Cinchona magnifolia*, which grows abundantly there, and had fruited during the rainy season, for the capsules were already open and empty on the day of my arrival. Seedlings of *Cinchona succirubra* we could plainly hope to find only in the vicinity of large trees in the virgin forest, and the latter have now become so scarce that, even with the aid of *cascarilleros*, our finding any such would be uncertain.

When Dr. Taylor had been ten days at Ventanas, a brief note from Mr. Mocatta was left at Guaranda by the Spanish Minister (on his return from Guayaquil to Quito), informing me that Mr. Cross had been taken suddenly ill when about to start for Ventanas. I therefore sent to recall Dr. Taylor, and after his return to Limon our operations were confined to visiting daily the bark trees and watching the progress of the fruit towards maturity, and to studying the accompanying vegetation. Nearly all through the month of July the weather was cool, with a great deal of mist and fog, so that the capsules scarcely increased in size. Many fell off, and some were attacked by a maggot and curled up. On the tree which bore most capsules, the latter began to turn mouldy, the mould being not fungi, but rudimentary lichens—a striking proof of the humidity of the climate. I began to fear we should get no ripe seeds this year, and as the seeds had been especially recommended to me in my instructions from England, it may be imagined how severe was my feeling of disappointment.

About the time of Dr. Taylor's leaving Ventanas, the troops of the Provisional Government of Quito began to march down from the sierra to attack the revolutionary forces, who held Guayaquil and the low country, and, contrary to all expectation, they selected the route by Limon and Ventanas. For six weeks we were kept in continual alarm by the passage of troops, and it required all our vigilance to prevent our horses and other goods being stolen; indeed, one of my horses was carried off, though I afterwards recovered it. It was now too late to think

* Descent from the pass of Chimborazo to Guaranda, in round numbers 6,000 feet (15,000 — 9,000). Ascent from Guaranda to the pass of Llullundongo 3,000 feet; and descent from Llullundongo to Limon 9,000 feet (12,000 — 3,000).

think of Dr. Taylor's going to Loja. Indeed, if I had had no companion who was independent of the political feuds of the country, I do not see how I could have got on at all; I might literally have perished of hunger. All our provisions had to be procured from Guaranda, and the barley-meal and pease-meal (which are the staple food of the Indians) soon deteriorate in a moist, warm climate; so that we could not get down at a time more than about a month's provisions. My servant, having a little white blood in him, could not stir from the place, or he would have been pressed for a soldier. The Indians could not travel alone, for they might be seized on to carry burdens or conduct laden beasts; so whenever our provisions fell short, Dr. Taylor had to take my horses and an Indian, and go all the long distance to Guaranda to purchase more.

Nearly all this time we were ignorant of Mr. Cross's fate; he might have died, or he might be on his way to join us, we knew not. I selected some fine healthy bark trees which had not flowered this year, and began seriously to think of trying to strike cuttings from them myself; when towards the end of July a vague report reached us that an Englishman, bringing with him a number of boxes, had arrived at Ventanas. On the strength of this, I immediately sent Dr. Taylor thither with horses, and he had the great satisfaction of finding and bringing up Mr. Cross, who reached Limon on the 27th of July. Mr. Cross had had all sorts of obstacles thrown in his way by the forces that held the river, and with the greatest difficulty found men to row his canoes; so that the distance from Guayaquil to Ventanas (which appears so short on the map) had taken him 13 days to travel.

After reposing the following day (Sunday), we had a piece of ground fenced in, and Mr. Cross made a pit and prepared the soil to receive the cuttings, of which he put in above a thousand on the 1st of August and following days. In three weeks some of them had begun to form roots; but in the meantime great difficulty was experienced in securing shade, when rendered necessary by the sudden alternations of fog and bright sunshine. At first, Mr. Cross shaded the cuttings with the fan-like points of the wild cane (*Gynerium saccharoides*) and with plantain leaves, but as these soon shrivelled up, we afterwards made of the fronds of the ivory palm a permanent fall-to roof, which could be elevated and depressed at pleasure. Later on, Mr. Cross put in a great many more cuttings, subjecting them to various modes of treatment (as the whole thing was an experiment), but constant watchfulness was needed to ensure their well-being, for what between caterpillars and burning suns he was sorely tasked to keep them alive.

Towards the end of July the weather took up, and in a few sunny days the capsules made visible advances towards maturity. On the 13th of August, I noticed that the capsules on the finest trees were beginning to burst at the base, and on the following day I had all taken off that seemed ripe, gathering them in this way: an Indian climbed the tree, and breaking the panicles gently off, let them fall on sheets spread on the ground to receive them, so that the few loose seeds shaken out by the fall were not lost. The capsules were afterwards spread out to dry on the same sheets, a process which occupied from two to ten days. The first seeds were taken off at Limon on the 14th, and the last on the 29th of August. Early in September they were all dry.

After bringing up Mr. Cross, Dr. Taylor went to Guaranda to purchase provisions, and on his return I despatched him to San Antonio, Pavon's original locality for the red bark, and two days' journey southward of Limon, where we had learnt that several young trees were still existing, on which flowers had been observed this year.

The climate of San Antonio proved more unhealthy than that of Limon. A hot sun is accompanied by winds out of all proportion cool and strong, so that rheumatic affections and ague prevail. This is, perhaps, the cause also of the backwardness of the seeds at San Antonio, although the bark tree extends lower down towards the Guayaquilian plain than at Limon. Dr. Taylor fell sick almost immediately after reaching San Antonio, had to bleed himself, and finally to go out to Riobamba in quest of remedies. On his return, the capsules were still green, and as he began to fear they would fall off without ripening, he crossed over to Limon to consult with me. The result of our consultation was that he should remain at Limon to assist Mr. Cross, and that I should go to San Antonio, whither I accordingly proceeded on the 12th and 13th of September; having before starting ascertained from Mr. Cross that double the number of plants we should require to fill the cases were already rooted, and only required time to become strong enough to travel.

At San Antonio a good many of the capsules had dried up while still unripe, and of those which had ripened some had burst open during the few days that intervened between Dr. Taylor's leaving San Antonio and my arriving there; but happily very few seeds were shed; and in gathering the capsules I profited by my experience at Limon that the seeds rarely fell out for two or three days after the capsules burst, and that the latter closed up again with the dews of night. So by gathering the capsules at day-break not a seed fell out, nor was there any need for the precaution (which, however, I still observed) of extending sheets whereon to receive the capsules as thrown down from the tree. I took off the first seeds at San Antonio on the 14th and the last on the 19th of September.

I had now gathered about 2,500 well-grown capsules, namely, 2,000 from 10 trees at Limon, and 500 from five trees at San Antonio. Good capsules contain 40 seeds each, in some I have counted 42, so that I calculate I have (in round numbers) at least 100,000 well ripened and well dried seeds. Had the month of July been as sunny as it is said usually to be, many more capsules would doubtless have ripened; as it was, only about one flower in ten produced ripe seeds.

Mr. Cross sowed at Limon, on the 16th of August, eight seeds taken at random from those I had gathered there; one of them began to germinate on the fourth day, and at the end of a fortnight four seeds had pushed their radicles. On the 6th of September one had the seed leaves completely developed, and by the 9th of the same month, or 25 days after sowing, the last of the eight seeds pushed its radicle. He also sowed eight seeds gathered by me in 1859, and which had remained nine months in my herbarium; of these, four germinated; I have, therefore, a well-founded hope that good ripe seeds will not speedily lose their vitality, and if daily watched and tended after sowing, will very likely most of them grow.

I had scarcely finished drying my seeds at San Antonio when I received the welcome intelligence that the troops of the Provisional Government had entered Guayaquil, and that, consequently, the communication with the interior was now open; I therefore resolved to proceed to Guayaquil, so as to be able to despatch from thence a portion of my seeds by the first opportunity, and afterwards to await there the arrival of my companions from Limon. My journey from Guayaquil occupied from September 28 to October 6, for I was delayed some days at Bodegas awaiting the arrival of the river steamer.

I now send, by the steamer which leaves Guayaquil for Panamá on the 14th instant, a packet of seeds for Sir W. J. Hooker, at the Royal Botanic Gardens, Kew, and another to the Botanic Gardens in Jamaica. I have not much faith of the trees succeeding at the latter place, on account of the violent winds which I understand occasionally to prevail there, and which would assuredly shatter to pieces the fragile leaves of the *Cinchona succirubra*.

The great bulk of the seeds I propose entrusting to Mr. Cross, and my own opinion is, that it will be best to send them at once to the locality in India destined for rearing the red bark tree. I trust that this locality may be the island of Ceylon, and that if Mr. Cross accompany the seeds and plants thither, he may be allowed to select the site where the experiment is to be tried, and of which I shall have no hopes of success if the soil and climate be not in exact conformity with those of the native forests of the Cinchona.

In conclusion, I feel some satisfaction in stating that, notwithstanding the length of time the task has occupied me, and including the remuneration I have agreed to give Dr. Taylor, the whole expenses have not yet reached 500 £., and I trust that, up to the time when I shall despatch Mr. Cross from Guayaquil, they may very slightly exceed that sum.

I have, &c.

(signed) *Richard Spruce.*

P.S.—I have preserved specimens of every plant I found in good state in the Cinchona forests, and shall have the pleasure of presenting them to the Herbarium of the Royal Gardens at Kew, to illustrate the rich vegetation accompanying the *Cinchona succirubra* at the base of Chimborazo. So soon as I have leisure to put my materials in order, I propose drawing up a fuller report, along with a complete copy of my meteorological register. In the meantime, I have made the following *résumé* of the latter, which may be of use in selecting the locality in India where the experiment is to be tried of rearing the red bark tree.

RÉSUMÉ of Observations on the Temperature in the Forest of Limon, on the Western Slope of Chimborazo, at about 3,000 feet in altitude.

Temperature of the earth, at a depth of 2 feet, $68\frac{1}{2}$ degrees.

Temperature of the air, from June 19th to June 30th :—

Mean minimum	-	-	-	-	-	61 $\frac{1}{2}$	degrees.
Mean maximum	-	74	degrees	(temp. at 6 $\frac{1}{2}$ p.m.,	68 $\frac{1}{2}$	degrees.)	
Lowest temperature (June 27th)	-	-	-	-	60 $\frac{1}{2}$		"
Highest temperature (June 29th)	-	-	-	-	77		"
Mean daily variation	-	-	-	-	12 $\frac{4}{5}$		"
Greatest daily variation (June 27th)	-	-	-	-	15 $\frac{2}{3}$		"

For the month of July :—

Mean minimum	-	-	-	-	-	60	"
Mean maximum	-	-	-	-	-	72 $\frac{1}{2}$	"
Lowest temperature (July 11th)	-	-	-	-	-	57	"
Highest temperature (July 27th)	-	-	-	-	-	80 $\frac{1}{2}$	"
Mean daily variation	-	-	-	-	-	12 $\frac{1}{2}$	"
Greatest daily variation (July 27th)	-	-	-	-	-	21 $\frac{1}{2}$	"

For the month of August :—

Mean minimum	-	-	-	-	-	61 $\frac{1}{3}$	"
Mean maximum	-	-	-	-	-	74 $\frac{2}{3}$	"
Lowest temperature (Aug. 12th)	-	-	-	-	-	59 $\frac{2}{3}$	"
Highest temperature (Aug. 28th)	-	-	-	-	-	80 $\frac{1}{2}$	"
Mean daily variation	-	-	-	-	-	13 $\frac{1}{3}$	"
Greatest daily variation (Aug. 28th)	-	-	-	-	-	19 $\frac{1}{2}$	"

From Sept. 1st to Sept. 9th :—

Mean minimum	-	-	-	-	-	62 $\frac{3}{4}$	"
Mean maximum	-	-	-	-	-	72 $\frac{1}{2}$	"
Lowest temperature (Sept. 3d)	-	-	-	-	-	61 $\frac{1}{2}$	"
Highest temperature (Sept. 1st and 6th)	-	-	-	-	-	76 $\frac{1}{2}$	"
Mean daily variation	-	-	-	-	-	9 $\frac{2}{3}$	"
Greatest daily variation (Sept. 4th)	-	-	-	-	-	13 $\frac{1}{2}$	"

Temperature of the air at Tabacál, near San Antonio, at an altitude of about 2,600 feet, from Sept. 15th to Sept. 27th :

Mean minimum	-	-	-	-	-	61 $\frac{3}{4}$	degrees.
Mean maximum	-	-	-	-	-	72 $\frac{2}{3}$	"
Lowest temperature (Sept. 15th)	-	-	-	-	-	60 $\frac{1}{2}$	"
Highest temperature (Sept. 23d)	-	-	-	-	-	76 $\frac{1}{2}$	"
Mean daily variation	-	-	-	-	-	11	"
Greatest daily variation (Sept. 23d)	-	-	-	-	-	15 $\frac{1}{2}$	"

The mornings were generally clear and sunny, but mist or fog predominated in the afternoons.

The wind at Limon scarcely ever amounted to a slight breeze. At San Antonio it was rather stronger, but still never of sufficient force to break the brittle leaves of the Cinchona.

The finest trees grow in a stratum of yellow or reddish marl, of immense thickness, and in which few or no stones were intermixed. A specimen of it will be sent in charge of Mr. Cross, along with specimens of the wood, bark, leaves, flowers, and fruit of the *Cinchona succirubra*.

R. S.

— No. 44. —

MR. SPRUCE'S REPORT on the Expedition to procure Seeds and Plants of the *Cinchona succirubra*, or Red Bark Tree, to the Under Secretary of State for India, 3d January 1862.

TOWARDS the end of the year 1859, I was entrusted by Her Majesty's Secretary of State for India with a commission to procure seeds and plants of the Red Bark tree, and I proceeded to take the necessary steps for entering on its performance.

Notwithstanding the vast extent of the unreclaimed forests in Ecuador, hardly any part of them is still without an owner, if we except the territory disputed between Peru and Ecuador, on the eastern side of the Cordillera, generally called "Las Montañas del Oriente;" and the forests known to produce the Red Bark are all private property. Some preliminary arrangement was, therefore, indispensable, before I could venture to take away young plants of so rare and precious a tree as the Red Bark. On inquiring about the ownership of the bark woods of Puma-cocha, in the valley of Alausi, which I had visited in 1859, I found they had belonged to a Dr. Bravo (of Cuenca), lately deceased, and that they were now the subject of litigation, so that any treaty made with either of the parties, who claims to inherit them, would most likely be null. I learnt, also, that the red bark,* obtained in that locality, fetched a much lower price at Guayaquil than the bark from the forests about the western foot of Chimborazo (generally called "of Guaranda"), not because the latter was known to contain a greater proportion of alkaloids, which is a test never resorted to here, but because it was of a rather deeper colour, and was brought to market in much thicker slabs. Before detailing the steps I took to obtain leave to collect seeds and plants in the forests of Chimborazo, a brief review of the ascertained distribution of the Red Bark tree along the western slopes of the Quitoian Andes will make what follows more clear.

For a great many years back no red bark has been got out beyond the latitude of $2\frac{1}{2}^{\circ}$ S., or a little to the southward of the river Yaguachi, and its tributary the Chanchán. Possibly, at an earlier period, the tree grew all along the roots of the Andes of Cuenca and Loja, to the limits of the Peruvian desert, in latitude about 5° S., as is indeed intimated by Pavon in his account of this species. To the north, it scarcely passes the parallel of 1° S., where it has been found about the base of the hill of Angamarca, a grassy peak standing north-west from Chimborazo, and considerably to the westward of the main ridge. Within these limits, it occupies a narrow band included between the meridians of $30'$ and $40'$ west of Quito.† Whether it exists still farther north, about the base of the snowy mountains, Ilinisa and Pichincha, and so on to the river Esmeraldas, is not known, nor does any search appear to have been made for it there. Beyond the limits of Ecuador, on the lower ridges of the Andes of Pasto and Popayan, which run down to the bay of Chocó, we have the conditions of climate and altitude requisite for the growth of *Cinchona succirubra*, but it has not yet been found there. The "Red Bark" of that district is rejected as worthless by the cascorilleros, as I learnt lately from a New-Granadian bark merchant whom I met at Guayaquil; and, on showing my specimens to him, and the figure of *C. magnifolia* in Mr. Howard's work, he immediately recognised it as the "Cascarilla colorada" of the bay of Chocó. Various barks of inferior quality having been called by this latter name, is perhaps the reason why what we call the true Red Bark is now known in Ecuador only by the name of "Cascarilla roja,"‡ which is useful as a distinctive appellation, although it does not denote the actual hue of that bark with more accuracy than the older name.

Within the ascertained limits of the true Red Bark it exists (or rather existed up to a recent period) in all the valleys of the Andes which debouch into the Guayaquilian plain. Many years ago it was obtained in large quantities in the valley

* "Red Bark" (with capital initials) indicates the tree, and "red bark" the bark of the same tree.

† Quito is in 78 degrees 45 seconds, or 5 hours 15 minutes, west of Greenwich.

‡ Roja means both blood-colour and fire-colour.

valley of *Alausi, below an Indian hamlet called Linje, on the northern side of the Chanchán (nearly opposite to Puma-cocha, which is on the southern side of the same stream), but it has long been exhausted there.* A race of cascarilleros still survives at Linje, and the adjacent hamlet of Guallanág, who are said to know of a site, which they call Untúm, a long way southward of the river, where there is yet standing a fine "manchon" or clump) of Red Bark; but they refuse to show the track leading thither, probably because no one will pay the price of their secret. Proceeding northward from the valley of Alausi, at the altitude of the Red Bark, we come successively on the valleys of Pallatanga and Chillanes, in neither of which is there a single large Red Bark tree remaining, though some years ago it was abundant. In 1858 I visited Pallatanga, where I could learn of but two young trees still existing. A branch of one of them was brought to me, so much withered as not to be worth preserving, and only sufficient to show that it belonged to some sort of *Cinchona*. In Chillanes, considered at one period the very best locality for this Bark, I am assured that a few slender shoots from old stools are all that remain. Leaving Chillanes and the river Chimbo, whose sources are on the western side of Chimborazo, we come on steep ridges (Cuesta de Angas, Cuesta de San Antonio, &c.), which run down from that mountain.† Towards their base, and in all the intervening valleys, the Red Bark formerly grew in abundance, but at present no large tree of it is known to exist to the southward of the parallel passing through Guaranda. The Bark grounds, which still continue to be worked, are bounded to the south by the ridge which separates the Rio San Antonio from its tributary, the Rio de Tablas, and

* There has lately been published a topographical work on Ecuador ("Geografía de la Republica del Ecuador. Por Manuel Villavicencio. New York. 1858,") which, as it is well printed on good paper, and is accompanied by a neatly-engraved map on a large scale, will probably be received in Europe with a degree of credit of which it is utterly unworthy. Besides the errors in description with which it abounds, the dates, distances, heights, and even bearings, can never be depended upon. The author seems to have no clear notion of the difference between north and south, or east and west, as he frequently uses one of those terms by mistake for its opposite. In the map he betrays his utter ignorance of the first principles of geography, by his erroneous numeration of the minutes of latitude and longitude; and the names are often so dislocated that, if he had written them on slips of paper, thrown them into the air, and afterwards stuck them down wherever they alighted on the map, they could hardly have been more out of place. In the whole region of the Red Bark there is not a single town or stream exactly where it ought to be. Linje, for example, is placed on the south side of the river Yaguachi, and higher up the stream than the cold village of Sibambe, whereas it is really on the north side, far lower down, and near to Guallanág. Even Guaranda, through which the author must have passed scores of times, is placed to the east of the Chimbo, whereas it is actually half a mile to the west of it. Of the course of the Chimbo itself, two accounts, totally at variance with each other, are given in the book, and neither of them agrees with the map. The Rio San Antonio, known by many different local names in its upper part, runs nearly west from the foot of the cuesta all the way down to the river Ventanas, which it enters near Caracal with the name Rio de la Pita. But on the map, the San Antonio and the Pita appear as two distinct rivers, and the former is made to run southward into the river Babahoyo! The work has already been severely criticised, and its more salient errors pointed out, by the Quito press, whose corrections will, however, hardly reach the hands of a single European geographer, and this is why I have thought it necessary to enter here my protest against it, especially as Mr. Howard seems to have been misled by it, in his speculations on the climate of the Red Bark. The only part of it which has really some merit is that which treats of the river Napo, where Villavicencio was stationed as governor for several years. Even the style rises when the author is writing about what he perfectly understands, and whereas the rest of the book is written in very vulgar and often ungrammatical Castilian, when he comes to tell us of the Napo and its inhabitants, his language, if not elegant, is generally clear and forcible.

† It is not well settled to how much of the cordillera the name "Chimborazo," should be limited. When an Indian speaks of "Chimborazo," "Tunguragua," &c., he means merely the snowy summit of those mountains, the adjacent *paramos* having local names, according to the streams which traverse them, or the farms and villages adjacent to them. Proceeding from Chimborazo southward, we have a lofty ridge, not rising in any part of it to the height of perpetual snow, varied here and there by slight depressions, but whose continuity is nowhere broken by any transversal valley. After forming the western boundary of the elevated plain or valley of Tiocajas, it sinks down abruptly from the heights of San Nicolas to the valley of Alausi, at the junction of the Puma-chaca and Chanchán. If the whole of this ridge be considered to belong to Chimborazo, then the forests of Linje are on the western slope of that mountain (as indicated by the person who furnished specimens of the Red Bark to Mr. Howard); but this course would necessitate a similar extension of the limits of Chimborazo on all sides, and we should have to include in it the adjacent mountain, Carguairazo, formerly equally lofty, and separated from it only by a very narrow valley, as also the two "knots" running eastward across the central valley to the foot of the eastern cordillera, the one from Sanancajas, and the other from the northern shoulder of Chimborazo (Paramo de Puenevata), both of which knots include some lofty peaks. I would rather confine the name Chimborazo to the mighty mass which rises abruptly from the plain of Sanancajas on the east, and reposes to the north and south on Puenevata and the Arenal respectively. On the western side, however, I can find no positive break from the summit down to the plain. There is no intervening salient peak, and no ridge whose origin may not be traced to the peak of Chimborazo.

and they form part of five contiguous farms, called respectively El Morado, Matiaví, Sinchig, Taláguai, and Salinas, whereof the two former belong to the church of Guaranda, and the three latter (which extend upwards to the *paramos* of Chimborazo, and downwards to the plain of Guayaquil) are the property of General and ex-President Juan José Flores, who, after a banishment of 15 years, has lately returned to take the chief part in the recovery of Guayaquil, from a faction who would have given it up to Peru. Only the high lands of those farms, where there is natural pasturage and ground suitable for the cultivation of potatoes and cereals, have been turned to any account by the proprietors. The middle part is dense, unbroken forest, and in the lower part, which produces the Red Bark, a good many poor people of mixed race from the sierra, and a few liberated slaves from the plain, have formed little cane farms, without asking leave of the owners, or paying any rent. The farms belonging to General Flores have been for some years leased to a Señor Cordovez, who resides at Ambato; and Dr. Francisco Neyra, notary public of Guaranda, rents the farms of the church, but only so far as respects the bark they produce. With these two gentlemen I had, therefore, to treat for permission to take from the bark woods the seeds and plants I wanted. At first they were unwilling to grant me it any price, but, after a good deal of parley, I succeeded in making a treaty with them, whereby, on the payment of 400 dollars, I was allowed to take as many seeds and plants as I liked, so long as I did not touch the bark. They also bound themselves to aid me in procuring the necessary workmen and beasts of burden. Through the intervention of Dr. Neyra, who has throughout done all he could to favour the enterprise, I engaged with his *cascarilleros* (who all inhabit the village of Guanujo, adjacent to Guaranda), that whilst they were procuring bark for him, they should also seek seeds and plants for me.

From Dr. Neyra I ascertained that a site called Limon would be the most suitable for the centre of my operations. There are many other "Limonés" in Ecuador, and there is even another on Chimborazo, by the main road leading to Guayaquil; but the Limon, where I was to establish myself, is at the junction of a stream of that name with the river Chasuán, which runs to the northward of, and nearly parallel to, the river San Antonio, and enters the river Ventanas with the name Sigümbi, at a place called Aguacatal, above the village of Ventanas, while the San Antonio enters the same river much lower down, near the village of Caracol. At Limon existed formerly the finest *manchon* of Red Bark ever seen. It was all cut down many years ago, but I was informed that shoots from the old roots had already grown to be stout little trees, large enough to bear flowers and fruit, and that the squatters (who are many of them *cascarilleros* of Guanujo), since they got to know the value of the bark, had carefully preserved such trees as were standing in their *chacras* or clearings. Messrs. Cordovez and Neyra have made their depôt for the bark about four leagues lower down the valley, where a stream called Camarón, running down the next transversal valley to the northward, joins the Chasuán.

The intestine war, alluded to in my "Notes" in the "Linnæan Journal" (Vol. iv., p. 176), still continued to rage, and the country was divided into two factions, whereof one held Quito and the whole of the sierra, and the other Guayaquil and the low country. Both maintained as large an army as they could raise in support of their cause, and pressed into their ranks all the suitable men they could lay hold on. Only those of pure Indian extraction were exempt from forced military service; but when the troops were marching about, they continually seized on Indians to carry their baggage and to drive laden beasts. For above a year there had been no mails between Guayaquil and the sierra, and my only means of communication with that port were by the rare passage of some diplomatic agent or courier, or of some foreigner well furnished with passports.

In the last instructions received from England, I was informed by Mr. Clements Markham that Mr. Cross, the gardener chosen to assist me in procuring the bark plants, would come out in December 1859. Before receiving that intimation, I had written to request that he might not come hither before May, for, until the winter rains cease, it is impossible to do anything in the forest, and on the western side of the Quitoian Andes they usually last until the end of May; but it was doubtful if my letter had even reached Guayaquil, so, acting on the supposition that he would come out at the previous date, I had three of my

horses put up to good feed, and I kept them and a man, for six weeks, in readiness to depart for Bodegas the moment I should hear of Mr. Cross's arrival. At the end of that period a letter, left at Guayaquil by Mr. Markham on his way southward, reached me, from which I learnt that Mr. Cross would not arrive there until May. I had not again a safe opportunity for the coast until early in June, when I wrote to Mr. Mocatta, Her Britannic Majesty's Consul at Guayaquil, requesting him to forward Mr. Cross (in case he had already arrived) up the river to Ventanas, which is the nearest port to the bark woods, on one of the numerous rivers that go to form the Gulf of Guayaquil.

In the account of my visit to Puma-cocha ("Linnæan Journal," l. c.), it will be remarked that I was guided by a person named Bermeo to the locality of the Red Bark tree. When I took leave of him, I informed him that very probably I should return the following year to procure seeds and plants. On the strength of this, towards the end of April, he travelled all the way from Lucmas to Ambato, nearly five days' journey, on foot, to tell me that he had just returned from the woods of Puma-cocha, where he had spent some days, and had found several trees of *Cascarilla roja*, which, though not of large size, were some of them coming into flower. He had besides got a few young plants for me at Lucmas, each in its bamboo pot. I explained to him that, for the present my re-visiting Puma-cocha was out of the question, but that I should be only too glad to have all his plants and seeds, and I fixed the price he was to receive on delivering them in sound condition to the British Consul at Guayaquil. I have only lately learnt that the poor fellow never ventured more from his forest home; indeed, he would hardly have been allowed to reach it again, but for a certificate I gave him, that he was travelling about on my account; and if he had gone to Guayaquil, according to our agreement, and escaped being made a soldier of by the way, he would assuredly not have been allowed to land there, except in uniform.

My preparations for entering the forest being completed, I was awaiting the coming of the dry season, when a severe attack of rheumatism so far disabled me that I determined to delegate my commission to Dr. James Taylor, of Riobamba. Animated, however, by his assurance that in the warm forest I might expect to recover the use of my limbs, I finally resolved to proceed thither in his company. Not to interrupt the rest of my narrative with the continual groanings of an invalid, I may say here, once for all, that the benefit derived from the milder temperature was almost neutralized by the fogs and damp; and, although upheld by a determination to execute to the best of my ability the task I had undertaken, I was but too often in that state of prostration when to lie down quietly and die would have seemed a relief.

We started from Ambato for the forest on the 11th of June. Our road was the same as I had travelled the preceding year, until reaching the *paramo* of Sanancajas, beyond the village of Mocha, where it turns to the right towards the southern shoulder of Chimborazo. In consequence of my having needed two long rests on the way, night came on and found us still on the *paramo*. Thin clouds had enveloped Chimborazo most of the day, but towards evening they gradually cleared away, and after sunset the majestic dome was entirely uncovered, though a slender meniscus of cloud, assuming exactly the form of the cope of the mountain, and still illumined by the rays of the sun (which had set for us) hung for some time like "a glory" over the monarch of the Andes. When this at length melted away, the light reflected from the snow by a clear star-lit sky enabled our beasts to pick their way. It was eight o'clock when we reached the tambo of Chuquipogyo, a solitary house, at between twelve and thirteen thousand feet of altitude. The rude accommodation and the inhospitable climate offered no inducement to a prolonged stay at Chuquipogyo, but, as I was so much exhausted as neither to be able to sleep nor on the following morning to mount my horse, there was no alternative but to remain there all the day and night of the 12th. At seven A.M. of the 13th we resumed our march. The day was fortunately fine, and we had only now and then a few drops of small rain and sleet, instead of the snow-storms with which the traveller has too frequently to contend in the pass of Chimborazo. The vegetation consisted chiefly of hassocks of a *Stipa* and a *Festuca*, so that the general aspect was that of a grey barren waste; but at short intervals we crossed deep gullies whose sides were lined with mosses, and sprinkled with calceolarias, lupines, and other pretty plants. Towards noon we came out on the "Arenál" (the *moraine* of the glacier, near the

the limit of all vegetation.* In a hollow a little below it, was a marsh with a rivulet, one of the sources of the Pastasa, in which I saw, not without surprise, a bed of the large-leaved *Rumex*, which is frequent in similar situations, at from 8,000 to 9,000 feet. The Arenal consists of sand and fine gravel of a pale yellow colour. In one place, the road, for a considerable distance, resembles a broad, smooth gravel-walk in England, so that the only bit of really good road in Ecuador has been made by nature's hand on the crest of the Andes. The vegetation is limited to scattered tufts, or rather hillocks, of a *Valeriana*, a *Viola*, an *Achyrophorus*, a *Werneria*, a *Plantago*, a *Geranium*, a *Draba*, a pretty silky-leaved *Astragalus*, and the elegant *Sida Pichinchensis*, all of which (save the *Astragalus*) have rigid leaves in the characteristic rosettes of super-alpine vegetation, and send enormously thick roots deep down into the loose soil, although even these do not secure them from being frequently torn up by the violent winds and storms that sweep over them. My attention was so much taken up with these interesting plants, and with the immense mass of snow on our right, and in tracing the downward course of ancient lava-streams, which are as visible on Chimborazo as on Cotopaxi and Tunguragua, that I scarcely felt the wind, which swept us along like a gale at sea, and occasionally lifted small fragments of gravel, and hurled them at us. It is scarcely necessary to state that the wind is here always easterly through the day, getting up strong generally about 10 A.M., and rarely continuing to blow with equal force through the night and following morning. Now and then it veers for a moment, and gives the traveller a side blow, which, were he not wary, might unhorse him.

We had left winter behind us on the eastern side of the cordillera, and on our first day's journey, as we looked down the deep valley of the Pastasa, we saw a mantle of dense cloud and rain spread over the forest of Canelos. Even the eastern side of Sanancajas was wet and muddy, but after passing Chuquipogyo the road became nearly dry, and on the western side of the cordillera it was even inconveniently dusty. In the direction of the Pacific not a cloud was visible, though the great distance and the hazy horizon prevented our actually seeing the ocean. So abrupt is the transition from the rainy season, which prevails on the eastern side of the cordillera simultaneously with the dry season on the western.

The Arenal must be near a league across. As we descended from it the whole mountain side became covered with flowers, and nowhere have I seen alpine vegetation in such prime state. *Gentiana Cernua*, with its large pendulous red flowers, formed large patches, and was accompanied by three other species of the same genus, with purple and blue flowers, by *Drabas*, and other alpinæ. Still descending, the true alpinæ began to be mixed with half shrubby *Fuchsia*, *Calceolaria*, *Eupatoria*, &c. Even before reaching the zone where these genera grow in the greatest luxuriance, and at less than 2,000 feet below the Arenal, we came on the first tree, a *Polylepis*, forming groves here and there along the declivity. The bark of this tree resembles that of the birch in colour, and in its peeling off in flakes; but if one could suppose an arborescent *Acæna*, it would give a better idea of the pinnate silvery foliage. On the opposite side,—not of Chimborazo, which is bare of trees, but of its sister mountain, Carguairazo,—a *Buddleia* approaches nearest the snow-line. In descending the same side of the cordillera, towards Pallatanga, 10 leagues south of Chimborazo, a *Podocarpus* and a *Berberis* ascend higher than any other tree, while a *Polylepis* (distinct from that of Chimborazo) ceases a thousand feet below them. On Chimborazo, on the contrary, the same *Podocarpus* fails a long way below the first-mentioned *Polylepis*. An accurate discrimination of the species is therefore needed, before we can compare their climatal distribution. I have unfortunately never met any species of *Polylepis* in a good state of flower or fruit.

Still descending, various other trees began to appear, such as *Buddleia*, *Myrcia*, and especially an *Araliacea*, called from its large palmate leaves (which are hoary beneath) "Puma-màqui," or tigers' paw. Here and there the track rounded the heads of *quebradas*, deep and dark, and full of low trees, which were laden with mosses.

At

* I possess a MS. of the late Colonel Hall, containing many valuable hypsometric data,—many of them ascertained in company with Boussingault,—wherein the height of the pass of the Arenal is given at 14,208 feet.

At about half-way down, we came out on a narrow grassy ridge, called the Ensillada (Saddleback), where several long low straw huts had been recently erected, for the accommodation of the soldiery, when marching that way. As we neared the encampment, four raw-looking youths armed with lances rushed out and confronted us, demanding our passports. We had none to show, but our antagonists did not look very formidable, and a shot from one of our revolvers would probably have put them to flight, had I not been furnished with a weapon which I have found far safer and more efficacious in such contingencies, namely, a bottle of strong aguardiente, a taste of which dispelled all opposition to our progress, and also served to induce the guardians of the pass to boil us water for making coffee.

Below the Ensillada we came on steeply-inclined strata of schists, across and down which we went on stumbling for at least a couple of hours; for, as the track runs over their projecting and jagged edges, which no pains have been taken to smooth down, we passed them not without inconvenience and danger. At this stage of our journey we became enveloped in cloud, which filled all the valley of Guaranda, so that we could thenceforth only discern objects near at hand.

We reached Guaranda just after night-fall, having travelled 11 weary leagues from Chuquipogyo. Guaranda is a rather neat little town, with good tiled houses built of adobes, and stands on ground which slopes down to the right bank of the Chimbo, at an elevation of about 9,000 feet. As it is on the main road leading from Guayaquil to the interior, it presents in time of peace a very lively aspect in the dry season, when it is constantly full of travellers and beasts of burden; but when we reached it there were not the least signs of traffic, and only soldiers were to be seen in the streets. The temperature is slightly warmer than that of Quito, and the adjacent hills are grassy, where not under cultivation. From the little I could see of the indigenous vegetation, it appeared interesting. A large *Thalictrum* was abundant, as was also a sarmentose *Labiata*, with spikes of second scarlet flowers, and a *Tagetes*, called, aptly enough, "Allpa-anis" (earth aniseed), from its scent and its lowly habit.

I was detained several days at Guaranda, partly in purchasing provisions for the forest, including an ox to be taken alive to our rendezvous, and partly in the vain attempt to procure licence for our cascarilleros (who had lately all been enrolled either in the line or the militia) to proceed to the forest; but I had to content myself with the assurance that, until the country was delivered from its present straits, not a single citizen could be spared for any other service. Only one of the cascarilleros, whose rancho we were to occupy, actually accompanied us to Limon, whether with leave or without I never knew, and he was there too much occupied in distilling cane-brandy, and in drinking no small portion of it himself, to be of the slightest use to us in seeking plants and seeds. Through Dr. Neyra's intervention, I secured the services of four Indians of Guanujo, and they proved of the greatest use to us, especially after we began to rear the Bark plants.

As far as Guaranda, two of our boxes had been carried by each beast of burden, but thenceforward, on account of the straitness of the path, they had to be carried singly. On the steep, narrow, and slippery tracks which traverse the western slope of the Quitenian Andes, the beasts of burden are chiefly bulls, called "cabrestillos," whose cloven hoofs enable them to descend with greater security than even mules. Our provisions of potatoes, pease, and barley-meal, &c., had to be carried in sacks so small, that two of them placed on the back of each cabrestillo did not project beyond the animal's sides.

We set forth from Guaranda on the 17th of June, the direction of our route being first northerly, as far as the adjacent village of Guanujo, and then north-west to the pass of Lullundongo, on a ridge of Chimborazo, nearly in front of the Ensillada (from which the deep, wide valley of Guaranda separates it), and at a height of about 12,000 feet. Having surmounted this, we entered on the most precipitous and dangerous descent I have ever passed. The track leads straight down a narrow ridge, varied at wide intervals by level steppes, rarely exceeding a hundred yards across. The soil, from the summit down to the very plain, is a yellowish or reddish loam, wherein the sandy element prevails in some parts, and in others the clayey; and it is of immense thickness, as we could see in the deep gullies worn in the mountain side by the rains, and in the landslips. Angular masses of rock are sparingly imbedded in it, and scattered on the surface, but rounded pebbles are rare.

The

The vegetation in the pass consisted of *Vaccinia* (especially *V. Mortiña* Benth.), *Gaultheria*, *Melastomaceæ*, *Compositæ*, &c., disposed in compact shrubberies, with intervening grassy glades. But we had scarcely turned the ridge before the forest became dense and continuous, at first low and bushy, but increasing in height at every step. At about 9,500 feet, we came on the first Cascarilla Serrana, or Hill Bark, and it accompanied us downwards to, perhaps, 8,000 feet. I could distinguish but one species, and the trees were unfortunately in the state most tantalizing to a botanist, the flowers being already fallen, and the capsules too young for examination. It is called indifferently "Cuchicara" and "Pata de Gallinazo," which I believe to be terms merely indicative of the relative facility with which the bark may be stripped off in different individuals, either of the same or of various species.

At three P.M. we reached the Rio de Tablas, a considerable stream of clear water, foaming over large stones; its roar had been audible for the last hour of our steep descent. We crossed it, and on a deserted clearing of some two acres drew up for the night, uniting all our rubber ponchos to make a fall-to-roof, to shield us from the night dews. The animals were turned loose to graze on the scanty grass in the clearing, and on the leaves of a *Chusquea* on the edge of the forest.

I have nowhere seen *Melastomaceæ* so abundant as in the forest surrounding our encampment. One species grows to a stout tree 40 feet high, and bears large pendulous panicles (a novel feature to me in this order) of blood-red flowers, with large turgid yellow anthers. A lower spreading tree, apparently a *Pleroma*, bore numerous large violet flowers. Other smaller sarmentose species had also large rose or violet flowers. Altogether, I have never seen so gay a forest vegetation, except on the river Uaupés.

We were still in a rather cool region, but the night was dry and the wind very slight, so that we had not to complain of cold. After an early breakfast the next morning, we followed our way, which became still narrower and rougher as we proceeded. We had to climb the high ridge separating the valley of the Rio de Tablas from that of the Chasuán, and then to descend to the latter river, but there were many subsidiary ridges, with intervening hollows, or sometimes nearly level crossings (called "*travesías*"). The track in the precipitous ascents and descents is mostly a gully worn in the soft loamy soil by the transit of men and beasts, to the depth in some places of 10 feet, and so strait, that the traveller, to save his legs from being crushed, must needs throw them on his horse's neck. Here and there, a large stone sticks out, forming a high step, in descending which, there is risk of both horse and rider turning a summerset. In the *travesías*, there is a considerable depth of black tenacious greasy mould, worn by the equable step of beasts of burden into transverse ridges (called "*camellones*," from their resemblance to the humps on a camel's back), with alternating furrows from one to three feet deep. This mould is formed in great part of the decayed leaves of the Suru, a bamboo of the genus *Chusquea*,* which forms almost impenetrable thickets, and whose arched stems and intricate branches, overhauling our way, much impeded our progress. In such places, there was still a good deal of water and mud, for the rainy season was only just over in the forest.

At 6,000 feet, we lost the wax-palm (*Ceroxylon andicola* H. et B.), which had accompanied us, though growing very sparsely, from about the upper limit of the Hill Bark. It descends to the same altitude on the eastern side of the cordillera. Lower down, palms began to be tolerably abundant, but of few species. A slender multicaul palm, with the pinnæ so remarkably eroso-truncate as to appear torn; I cannot refer to its genus, for want of flowers or fruit. A *Euterpe*, with

*The *Chusquea* are bamboos peculiar to the hills, with solid stems, rarely exceeding 30 feet in height, and not preserving an erect position for more than a few feet from the ground; but though I have many times examined them, I could never detect any actual twining in either the stems or the long branches, which merely thread amongst each other and the adjacent trees, so as to form an entangled mass. The *Chusquea*, seen on the way to Limon, rarely descends below 5,500 feet; but what seems the same species, descends in the valley of the Pastaza to 4,500 feet, where it meets the large hollow-stemmed *Guadua*. Another and far slenderer species grows in the valley of Alausi, at about 5,000 feet. In the Andes of Maynas, there is no *Chusquea*, nor (what is more singular) did I see any *Guadua* there. In their stead, an elegant *Merostachys* grows on the hill tops, where the hollow internodes of the sterile stems afford a copious draught of pure water to the thirsty traveller.

with slender solitary stems, forms large beds at from 4,000 to 5,000 feet; and between these limits, we first fell in with the *cadi* or ivory palm, which extends thence to the plain.

At a very little below 4,000 feet, we came out on the first *chacras* at Limon, where I almost immediately noted, and with no small satisfaction, a group of three Red Bark trees, each consisting of from two to four stems of 30 feet high, springing from old stools, and bearing a small quantity of fruit. We had still about two miles of gentle descent to the *trapiche* (cane-mill) destined for our habitation, and we reached it early in the afternoon, in the midst of a dense fog.

The *trapiche* stood on a narrow ridge, running eastward and westward, sloping gradually on the northern side to the Chasuán, distant half-a-mile, and very abruptly, or 200 feet perpendicular in about 300 yards, to a tributary rivulet on the southern side. It was merely a long low shed, and a sketch of its internal arrangements may serve for that of all the other *trapiches*, for which there were about a dozen at Limon. About two-thirds of its length was occupied by the rude machinery and adjuncts of the cane-mill. The remaining third had an upper story with a flooring of bamboo planks, half of it open at the sides, and the other half with a bamboo wall about six feet high, not reaching the roof in any part of it. This was our dormitory, and it was reached by a ladder, merely a tree trunk, with rude notches for steps. On the ground floor was the kitchen, with a wall of rough planks of raft-wood, placed by no means in juxtaposition, but not so wide apart that a dog or a pig could have got through the interstices. The whole fabric was, therefore, abundantly ventilated, and only too frequently filled with fog, as we found to our cost, in coughs and aching limbs, and in mouldy garments, saddles, &c.

Having reposed a day at Limon, Dr. Taylor went on with my horses two days' journey to Ventanas, hoping to find Mr. Cross there, and to bring him up. During his absence, I had to look after killing the ox, and drying the beef, and to repair our dwelling, which was sadly fallen to decay, especially as to the roof. I therefore set the Indians to drag bamboos and palm leaves out of the forest, with which we patched up the hut as well as we could. I visited also all the Bark trees known to exist within a short distance, and was well content to see on many of them a good crop of capsules, which had already nearly reached their full size on the finest trees; on other trees, however, there were only very young capsules, and even a good many flowers, so that I might have obtained at least 30 good flowering specimens; but, wishing to gather as many seeds as possible, I dried only a couple of specimens, which I had afterwards cause to regret, for not one of the late-flowering panicles produced ripe capsules. I learnt from the inhabitants that the trees had been covered with blossom in the latter part of April and beginning of May.

When Dr. Taylor had been 10 days at Ventanas, a brief note from Mr. Mocatta was left at Guaranda by the Spanish minister (on his way from Guayaquil to Quito), informing me that Mr. Cross had been taken suddenly ill, when about to start for Ventanas. I therefore sent to recall Dr. Taylor, and after his return to Limon, our operations were confined to visiting the Bark trees daily, which extended through a zone of about four miles in breadth, and to collecting and studying the accompanying vegetation. As we had a fair share of sun towards the end of June, I was in hopes the fruit would speedily ripen; but nearly all through the month of July, the weather was cool, with a good deal of mist and fog, so that the capsules scarcely increased in size; many fell off, and some were attacked by a maggot and curled up. On the tree which bore most capsules, they began to turn mouldy, the mould being not fungi, but rudimentary lichens, which, whilst it proved that the capsules were still alive and growing, proved also that they were exposed to an atmosphere almost constantly saturated with moisture. I began to fear we should get no ripe seeds, and as the seeds had been especially recommended to me in my instructions from England, it may be imagined how severe was my feeling of disappointment. I had another motive for fearing the same result. The people of Limon had got a notion that I should buy the seeds of them, and one morning, when I made my round among the trees, I found that two of them had been stript of every panicle, undoubtedly by some one who calculated on selling me the seeds. This was very provoking, for the seeds were far from ripe, and all the rest might be destroyed in the same way, so I immediately went round to the inhabitants, and informed them that the seeds would be of no value to me unless I gathered them myself;

myself; and I offered a gratuity to the owners of the chacras where there were trees in fruit, to allow no one to approach the trees except myself and Dr. Taylor. This had the desired effect, and I do not think a single capsule was molested afterwards.

Whilst Dr. Taylor was at Ventanas, the troops of the Provisional Government of Quito began to march down from the sierra, to attack the forces which held the low country, and they selected the route by Limon and Ventanas, along which an army had never been known to pass. For six weeks we were kept in continual alarm by the passing of troops, and it needed all our vigilance to prevent our horses and goods being stolen; indeed one of my horses was carried off, though I afterwards recovered it. It was now clear that, unless there had been two of us, both independent of the political feuds of the country, the enterprise must have fallen through. All our provisions had to be procured from Guaranda, and, as they soon deteriorated in a most warm climate, whenever our stock got low, Dr. Taylor had to take my horses and an Indian, and go all the long distance to Guaranda to fetch more. The squatters at Limon, being all highland men, do not take to the food of a warm climate, and they rear no more plantains than suffice to give them an occasional zancocha. About half a day's journey down the valley there were a good many plantains on a deserted farm, and at twice the distance a negro had a fine plantation of them, from which I two or three times got up a mule-load; but the hungry soldiery soon made an end of them, and then even that resource was cut off.

During the long time I had to await the arrival of Mr. Cross, and until the Cinchona seeds ripened, I had ample time for examining the site of the Red Bark tree, and the characteristics of the accompanying vegetation; and I proceed to detail the observations made on those points, up to the period of my departure from the bark forests in September.

The *manchon* of red bark at Limon lies very nearly west from the peak of Chimborazo. The river Chasuán rises on the northern shoulder of that mountain, and runs for a long distance between south and west, till its junction with the Limon (about a mile above our hut), when it turns gradually to the westward, which is thenceforward its general direction until it enters the Rio de Ventanas. At Limon it may be compared to the Wharfe at Bolton Abbey, in size and appearance. The lower part of the Limon has also a westerly direction, from a short distance above its junction with the Chasuán, but in its upper part it runs south-westerly, and its sources seem to be far below the *paramos* of Chimborazo. There are also a vast number of rivulets, tributary to the Chasuán and Limon, and all, as well as the main stream, run with a rapid course, rarely forming cascades of more than a few feet elevation, down deep narrow dales. Even the main valley does not begin to open out until below the region of the Red Bark. The ridge forming the watershed between the Chasuán and the Rio de Tablas subsides very gradually down to the plain, and may be traced nearly to the river Ventanas.

The view from Limon takes in a vast extent of country, both upwards and downwards, and the whole is unbroken forest, save towards the source of the Chasuán, where a lofty ridge rises above the region of arborescent vegetation, and is crowned by a small breadth of grassy *paramo*. Nowhere are there any bare precipices; and a very steep declivity, forming an angle of 60 degrees with the horizon, appearing far away up the Chasuán, is as densely wooded as any other part. The opening at Limon, it will be understood, is purely artificial.

The crystalline waters of the Chasuán and its tributaries, in that part of their course where the Red Bark grows, run over a black or dull blue, shining, and very compact trachyte, which would seem to be the foundation of the Quitenian Andes, for it appears almost everywhere in the lower valleys, on both the eastern and western declivities. In the river Pastasa it occurs at from 3,000 up to 7,000 feet. Generally it is exposed to view only in the bed of the streams, or on their banks, where it often rises into rugged and fantastic cliffs. Over the trachyte at Limon there is to be seen in the bottom of the valleys a fine-grained ferruginous sandstone of a deep brown colour, in thick strata, and usually in large detached masses, lying either horizontally or variously tilted up. I suppose, therefore, that, so far from having been deposited over the trachyte, it is merely the remains of a large bed of rock, which once extended conformably over the whole region, and has been shivered and dislocated by the upheaval of the trachyte itself. It seems the same sort of rock as exists about the base of Tun-

guragua, and forms the lofty cliffs on the southern side of that volcano, where the cataract of Guandisagua comes down at three bounds from the edge of the snow to the warm valley of Capíl, in which grow oranges and the sugar-cane. I have never been able to find any trace of fossils in this rock, and without these my very slight knowledge of geology is insufficient to determine its age; so that when I suppose it to be Silurian, my opinion has no more value than a mere guess. Nowhere in the Quitenian Andes have I seen the stratified rocks, limestones, friable sandstones, and fossiliferous shales, all, I believe, belonging to the lias formation, which constitute the eastern declivity of the Andes of Peru, or at least of the province of Maynas. No bark tree was seen growing on rock of any kind. The soil at Limon is the same deep loamy alluvial deposit, with very few stones intermixed, as we had seen from Lullundongo downwards, nor does a bit of rock crop out in the whole of the descent. The ridges on which the Red Bark grows all deviate little from an easterly and westerly direction. It is far more abundant on their northern than on their southern slope, nor did I see a single tree with flowers or fruit in a southern aspect. The northern and eastern sides of the trees themselves had borne most flowers, and, except on one tree of more open growth than the rest, scarcely a capsule ripened on their southern and western sides. These phenomena are explained by the fact that, in the summer season, the trees receive most sun from the east and north, for the mornings are generally clear and sunny, whilst the afternoons are almost invariably foggy, and the sun's declination is northerly. Another notable circumstance is that the trees standing in open ground, pasture, cane-field, &c., are far healthier and more luxuriant than those growing in the forest, where they are hemmed in and partially shaded by other trees, and that, while many of the former had flowered freely, the latter were, without exception, sterile. This plainly shows that, although the Red Bark may need shade whilst young and tender, it really requires (like most trees) plenty of air, light, and room, wherein to develope its proportions.

From an old man named Toscano, one of the primitive settlers at Limon, I learnt the following particulars. 30 years ago, he and a few others opened the first chacras there. He himself chose a site at more than 4,000 feet elevation, but, finding it rather too cool for his crops, and that the forest was much infested by bears and pumas, which carried off his animals, he afterwards moved about 1,000 feet lower down.* The Red Bark was then very abundant, and on some slopes formed large clumps, with scarcely any intermixture of other trees. The settlers found it made excellent firewood, so they cut it up ruthlessly for that purpose. A good many years ago, it may be 15, it may be more (for the old man's memory is not very perfect for dates), a bark-dealer came to Limon (Toscano believes from Cuenca), who offered the settlers a dollar a piece for every tree they showed him. As the bark was of no value to them, and they still had the wood for firewood, the terms seemed advantageous enough; so the bark-dealer cut down large trees which yielded him 500 lbs. of dried bark each, for the price of a dollar and the expense of getting the bark down to Guayaquil, the whole being only a slight per-centage on the value of the bark to him. In the next and succeeding years other dealers followed the example; every ridge and valley for a great distance around was searched, and the destruction of the bark went on unsparingly. It grew mostly on the farms of General Flores, which were then deserted. Even the cultivated lands in the cool region had run to waste, and the fine corn-mills, for which the General had got machinery from Europe, were in ruins. At length those farms were leased to Señor Cordovez, who had already worked a good deal on bark in New Granada, and the bark-dealers, who had been fattening on other people's property, were excluded. But the mischief was already done, very few large trees were left, and those far apart; nor, since the bark was begun to be worked, can I make out that more than one manchon has been met with at all comparable to that of Limon.

The cascarilleros have found out that the bark is worth money, but neither they nor the greater part of the inhabitants of Ecuador have any correct idea of the use that is made of it in foreign countries; the prevalent opinion being that a permanent coffee or chocolate-coloured dye (still a desideratum in Ecuador) is extracted

* The first chacra reached in descending from Guaranda is still called "Osocahuítu," or the Bears' Den.

extracted from it. I explained to the people of Limon how it yielded the precious quinine, which was of such vast use in medicine; but I afterwards heard them saying one to another, "It is all very fine for him to stuff us with such a tale; of course he won't tell us how the dye is made, or we should use it ourselves for our ponchos and bayetas, and not let foreigners take away so much of it." There is to this day the same repugnance to using the bark as a febrifuge, as Humboldt remarked 60 years ago, and as exists also in New Granada, where cedron and various other substances are preferred to quina. I think I can explain this repugnance. The inhabitants of South America, although few of them have heard of Dr. Cullen, have a theory which refers all diseases to the influence of either heat or cold, and (by what seems to them a simple process of reasoning) their remedies to agents of the opposite complexion; thus, if an ailment have been brought on by "calor," it must be cured by "frescos;" but if by "frio," with "calidos." Confounding cause and effect, they suppose all fever to proceed from "calor." Now, they consider the cascarilla a terribly strong "calido," and justly; so, by their theory (which is the reverse of Hahnemann's), its use could only aggravate the symptoms of fever. A lad employed in the *trapiche*, where we resided, had been to the low country about Ventanas, and on his return was attacked by fever. Decoctions of mallows and barley, and other "frescos," by no means so harmless, were administered, but the patient only got worse. Dr. Taylor indicated the treatment they ought to pursue, and as they would not use bark, I offered to give them quinine; but they had evidently a great horror of it, and had I given it to the lad in the remissions of the fever, they would have mixed nostrums of their own; so that, had the case gone wrong, the blame would have been laid on us. At length, when he was much attenuated, he was taken up to Guanujo, and I never learnt whether he died or recovered, although marsh fevers are generally cured, as if by magic, by simply removing the patient to the cool rarefied atmosphere of the Andes.

Even at Guayaquil, there is such a general disinclination to the use of quinine, that, when the physicians there have occasion to prescribe it, they indicate it by the conventional term "alcaloide véjetal," which all the apothecaries understand to mean "sulphate of quinine," while the patient is kept in happy ignorance that he is taking that deadly substance.

The lowest site of the Red Bark at Limon is at an elevation of 2,450 feet above the sea, where the Chasuán receives the rivulet already mentioned as running below our hut. It is precisely the point where the track from Ventanas leaves the Chasuán (along whose margin it had run thus far, with a gentle ascent from the plain), and begins to ascend the steep *cuesta* separating the Chasuán from its tributary, the ascent being 350 feet in the first 500 yards; so that where the real ascent of the Andes begins, there also begins the Red Bark. At San Antonio, however, I saw a tree at a height of no more than 2,300 feet; and, if I might believe my informants, trees of immense size have been cut down at points whose height I estimate at barely over 2,000 feet. Following the track leading to Guaranda, the last bark trees growing by the road-side are at a height of 3,680 feet; but leaving the track, and following the hill-side on the left bank of the Limon, there are bark trees scattered about for a distance of a league, and up to a height of near 4,500 feet. On the opposite ridge, or that separating the Limon from the Chasuán, there are also several trees ascending to a still greater elevation, or nearly to 5,000 feet; but I did not take the barometer to these latter, which were all sterile, in consequence of growing in lofty forest.*

From

* In order that my barometrical observations, and the deductions therefrom, may be received with neither more nor less confidence than they merit, I subjoin the following explanations. My barometer (an Aneroid) was sent out to me by the late Admiral Sir Francis Beaufort, and I received it at the Barra de Rio Negro, in the year 1851. At that time, its zero point was considerably higher than it ought to have been, but I did not attempt to rectify it, for I soon found that it was still slowly rising. By observations renewed at various points, and at considerable intervals of time, and especially on my return to the Barra de Rio Negro, after an absence of more than three years, I ascertained pretty accurately the rate of my barometer. In July 1858, I took it to Quito, hoping to compare it there with some mercurial barometer, but I found only two such in the whole city, and both of them out of order. I had, therefore, to content myself with repeated observations at the tablet erected by the French Academicians in the Jesuit's College (now the University), and I have since compared its indications with those registered by Colonel Hall (in the manuscript above alluded to) at various points in the Quitenian Andes. The observations made in the Red Bark forests depend entirely on the mean barometer at Ambato. I hoped to obtain another important element for correcting my instrument on the shores of the Pacific, but

From the cascarilleros I learnt that although the bark trees growing nearest the plain were generally much larger, yet their bark was by no means so thick in proportion to their diameter as in trees higher up, which I can well believe, for in cutting down trees in the hot plains, I have often been struck with the thinness of the bark compared to that of trees growing in temperate climes. They estimate the circumference of the trees by spanning round them with their fingers, and consequently speak of them as being of so many "cuartas" or spans. (A cuarta is about $8\frac{1}{2}$ English inches.) The bark is usually not weighed until after being dried; but they have sometimes been curious enough to weigh the fresh bark, and they gave me the following account of the produce of three trees:—

A tree of 5 cuartas (= 3 ft. $5\frac{1}{2}$ in.) gave 4 quintals of green bark.

A tree of $7\frac{1}{2}$ cuartas (= 5 ft. 2 in.) gave 15 quintals of green bark.

A tree of 14 cuartas (= 9 ft. $7\frac{1}{2}$ in.) gave 9 quintals of green bark.

Seven pounds of green give four pounds of dry bark; but in trees that are not full grown the bark sometimes loses fully half its weight in drying. The tree which yielded 15 quintals of green bark, or $8\frac{1}{2}$ quintals (= 850 lbs.) of dry bark, was the most productive ever cut down. I was shown its site, in the valley of the Limon, at nearly 4,500 feet elevation. A tree almost equal to it was found, in 1859, to north-east of Camaron. The tree, which measured 14 cuartas in circumference, over an English yard in diameter, grew at the lower limit of the Bark region, and the bark was very thin in proportion to the wood. I asked the cascarilleros to point out to me any tree in the forest which seemed to them about the height of these large cinchona trees, and they showed me some of 80 feet, adding that the Red Bark scarcely attained the average height of the virgin forest.

The cascarilleros do not usually go in quest of bark-trees before August, there being generally less fog in that and the following month than at any other period of the year. They go in parties of from four to eight, and each man carries his bag of *mashca* (barley meal), a little toasted maize, salt, lard, onions, and two cakes of *rapadura* (uncrystallised sugar). Those who possess guns take them, as they are necessary for procuring game to eke out their scanty provisions; but the *machete*, or cutlass, is essential to every one. They descend nearly to the plain, and seek out some ridge which they have never hunted. Two men, called "monteadors," go ahead, opening a narrow track through the brush with their machetes, often a slow and fatiguing process; when they give in, other two take their

when I opened it, on reaching Guayaquil, the pointer had ceased to travel, and, on inspecting the mechanism, I found that the vacuum vane had altogether collapsed, so that my barometer is of no further use to me in the plains.

I calculate the height of Ambato above the level of the sea at 8,567 English feet, by Laplace's formula, from the following elements:—

Lat. $1^{\circ} 15' S$. Mean bar. 22.218 in. Mean therm. 60 degrees (as it is within a very small fraction).

Mean bar. at surface of Pacific, 30 in., and mean therm. at ditto, 80 degrees (Hall).

I follow Hall in assuming 30 inches for the barometer at the sea level, not taking into account the equatorial depression, generally estimated at one-fifth of an inch. When I came out to the mouth of the Amazon, in 1849, the ship's barometer stood constantly above 30 inches, from about the latitude of Madeira to a long way beyond the tropic, when it gradually sank, and near the equator, where we were becalmed for several days, and afterwards ran for the coast of Brazil as near the actual line as we could, the barometer at noon marked 29.85 in., without any perceptible variation for 13 days together, namely, from June 28th to July 10th. When we ascended the river to Pará, the barometer fell to 29.83 in.

The height above the sea of our hut at Limon I find to be 2,836 feet from these elements:—

Lat. $1\frac{1}{2}$ degree S. Mean bar. 27.1775 in. Mean therm. 67 degrees.

I had not with me in the forest any formula for the calculation of heights, nor unfortunately the correction required for my barometer. I could only be certain that the barometer at Limon indicated a height of less than 3,000 feet, at which figure I roughly assumed it, and as the barometer, on being taken to Tabacal, showed that I had descended some 400 feet, I took the height of Tabacal at 2,600 feet. These heights have proved nearly 200 feet too great, a difference of altitude too small to be accompanied by any appreciable difference of temperature.

I assumed the range of the Red Bark in the valley of Alausi at 3,000—5,000 feet, from Bermeo's rough indications as to how far the tree extended up the Puma-cocha and down the Yaguachi, and it has proved not far from the truth. I gathered an undescribed *Cinchona*, scarcely more than a shrub, at a height of 4,000 feet, on Mount Campana in Maynas. The sub-genus *Cascarilla* (for to me it is no more than a sub-genus, and scarcely even that) has one representative in the Amazonian plain, namely, at the falls of the Rio Negro, and others in the eastern roots of the Andes. The genus *Remijia*, the "Quina-rana," (or bastard Quina) of the Brazilians, rarely ascends out of the plain.

their place. In this way they go up the crest of the ridge until they see no more bamboo in the valleys on each hand, when they know they have passed the limit of the Red Bark, and that it is useless to seek any higher.* If they have been unsuccessful, they betake themselves to a collateral ridge and renew their search. When the day is clear, they can obtain a view over the valleys on both sides, by climbing some high tree; but when it is foggy, they seek only on the ground for the blood-red *Cinchona* leaves, and even these cannot be seen unless close at hand, if the fog be very dense. When their provisions fail they think of returning, and as, by looking out from an elevation and tracing the course of the streams, they can generally tell the direction of Limon, they often arrive there again in a day or two, from points which they had taken 10 or 15 days to reach. If their search has been finally successful, they return almost immediately to the forest, with a larger stock of provisions, and with Indians to assist them, especially in carrying the dry bark to Camaron. The trees being cut down and the roots dug out, the bark is stripped off much in the same way as oak bark in England, but no other tool than the machete is used. As flat slabs are most appreciated in the market, they rarely make the strips of more than three or four fingers' breadth, for if broader they curl in drying. They have tried to dry broader slabs by fastening the bark to a piece of bamboo, back to back, but as the bark contracts it splits the bamboo. For drying the bark, a stage three feet high is erected, called a "*tendál*," which is precisely the "*muca-en-táua*" used for drying fish on the Amazon. Care must be taken that the flame from the fire beneath the *tendál* does not reach the bark, and if rain be apprehended, the whole has to be roofed over. When the bark is perfectly dry, they have only to convey it to the depôt at Camaron, and receive their 20 dollars per quintal, which is the price usually paid them by Messrs. Cordovez and Neyra; or rather, they have generally received the value in advance, according to the custom of the country, the expenses thus far having been borne by the cascarilleros. From Camaron the bark is conveyed on mules' or Indians' backs to Ventanas, and thence on a raft to Guayaquil, all at the cost of the owners. The entire quantity of the red bark collected in 1859 did not reach 50 quintals, and it was sold for 43 dollars the quintal. In 1860, no red bark at all was got out, so that the trade in it is well nigh extinct.

When the red bark began to be worked at Limon, it was not the custom to strip the bark from the roots; and although a few old stools have since been destroyed for the sake of the bark on their roots, a great number still exist, and have almost without exception grown out again. The shoots grow in a decussate manner, two, four, six, or even eight from the base of the old trunk (of which some six inches has mostly been left), and their vigour and luxuriance is something extraordinary. A few of them have already reached 50 feet in height, and the greater part of them are from 30 to 40 feet. On some stools by the wayside the shoots have been wantonly and repeatedly cut away, and yet others continue to grow out.† Comparing Toscano's account with that of other settlers, it appeared

* This bamboo, whose stout hollow stems grow to 80 feet high, abounds in moist flats and hollows in the roots of the Quitenian Andes, on both sides, and I have nowhere seen it at a greater altitude than 5,000 feet, so that it forms an excellent guide to the upper limit of the Red Bark. Wherever it descends to the plain, on either side, it is with dwindled dimensions. On the Rio Negro and the Alto Orinoco it grows nowhere wild, and wherever a grove of it is seen, it uniformly indicates a *Tapêra*, as the sites of ancient *malocas* (villages) are called. Von Martius makes a similar remark respecting the river Japurá, in his interesting "*Observatio Geographica*," affixed to the "*Agrostologia Brasiliensis*." "*Ipse ego in sylvis ad flumen Japurá ejusmodi densa Bambusearum fruteta triginta et quod excedit pedes alta, conspexi, forsan Bambusa latifolia, Kunth, efformata; comitesque Indi, ubi nobis occurrerent, id argumento sibi dicebant esse, olim pagos hic indicos (Malocas) fuisse.*" I have always supposed this bamboo to be the *Bambusa* (*Guadua*) *angustifolia* of Humboldt and Bonpland, which those travellers found in the Montana de Quindiu, up to 5,575 English feet; but, as I have never found it in flower, my materials are insufficient to decide the question. All the *Guaduas* seem to have hollow stems, unless a remarkable solid-stemmed bamboo I gathered in flower at the mouth of the Rio Negro (Pl. Exs. 1196), be correctly referred to that genus.

† As the trees grow out again so readily from the crown of the root, I would suggest that, in the event of the attempt to form plantations of the Red Bark in India being successful, when the trees attain a sufficient size to be worth cutting down for the bark, the roots should not be molested, for they extend but a short way from the crown, and really yield a very small quantity of bark, although that is of excellent quality. At Limon, two trees, shoots from old stools, and supposed to be about 15 years old, were marked to be cut down in 1861, when it was calculated they would yield two quintals of bark each.

appeared that not fewer than 13 years, and probably not more than 15 years, must have elapsed since the mass of the Red Bark was cut down at Limon. As the scar of the opposite leaves and stipules forms a complete ring, which is not speedily obliterated, for the rings were distinct even to the very base of some trees, I tried to count the rings, in order to compare their number with the age assigned to the trees; but I found it impracticable whilst the trees were standing, and on two trees we had to cut down, the one for cuttings, the other for its seeds, the rings were unfortunately very indistinct. It was impossible to ascertain how many rings were formed each year, unless I had remained there all the year through. Near the equator, where the amount of light and heat varies so little throughout the year, and plants live under unceasing excitement, the growth of trees goes on almost continuously; not by any means at the same rate in every month, but never suspended entirely, except for a brief period antecedent to the time of flowering. In those plants which are ever flowering, or flower at brief intervals, there can scarcely be any suspension of growth. The ramuli of *Cinchona Succirubra* have from four to six pairs of leaves contemporaneously, but during my stay they were continually lengthening at the point, forming new leaves and throwing off old ones, and I suppose would go on doing so until the month of January at least; nor could I clearly trace any break between the growths of the two preceding years.

In the valleys of the Chasuán and Limon I saw about 200 trees of Red Bark standing. Out of the whole number, only two or three were saplings which had not been disturbed; all the rest grew from old stools, whose circumference averaged from four to five feet. I was unable to find a single young plant under the trees, although many of the latter bore signs of having flowered in previous years. This was explained by the flowering trees growing uniformly in open places, either in cane-fields which had been frequently weeded, or in pastures where cattle had grazed and trodden about. The young plants, which I had been assured I should find abundantly, proved to be either stolons or seedlings (very few of the latter) of the worthless *Cinchona* (*Cascarilla*) *Magnifolia*, which grows plentifully at Limon, and must have fruited during the rainy season, as the capsules were all burst open when I arrived there.

Cinchona Succirubra is a very handsome tree, and, in looking out over the forest, I could never see any other tree at all comparable to it for beauty. Across the narrow glen below our hut, and at nearly the same altitude, there was a large old stool, from which sprang several shoots, only one of which rose to a tree, while the rest formed a bush at its base. This tree was 50 feet high, branched from about one-third of its height, and the coma formed a symmetrical though elongated paraboloid. It had never flowered, but was so densely leafy that not a branch could be seen; and the large, broadly oval, deep green and shining leaves, mixed with decaying ones of a blood-red colour, gave the tree a most striking appearance. *C. Magnifolia*, called here "*Cascarillo Macho*" (male bark), grows rapidly to be a large tree. I saw one which must have been over 80 feet high, and I cut down a young tree which measured 60 feet. Saplings of 15 to 20 feet have a very noble appearance, from the large heart-shaped leaves, little short of a yard long; but in full-grown trees, the ramification is so sparse and irregular, and the leaves are so much mutilated by caterpillars, that all beauty is lost. This species sends out stolons from the root, which sometimes form a matted bed, looking like a growth of seedlings. I have not observed the same peculiarity in any other *Cinchona*. The bark of *C. Magnifolia* is of as deep a red as that of *C. Succirubra*, but rather duller, nor do I notice the transverse cracks in the epiderm, that exist in all but very young trees of *C. Succirubra*.

I inquired of the cascarilleros what varieties they distinguished in the Red Bark, and they signalled the following:—

- Cascarilla roja de jugo lechoso*, with milky juice.
- " " *de jugo aguado*, with watery juice.
- " " *de hojas crespas*, with wavy leaves.
- " " *de hojas llanas*, with plain leaves.
- " " *Pata de Gallinazo*, with very adhesive bark.
- " " *suelta*, with easily separable bark.

As to the first pair of differences, they appear to depend entirely on the trees being barren or fertile. When the trees are in flower, and especially when the fruit

fruit is ripening, the sap concentrates in the panicles, and only a little watery juice exudes on wounding the trunk. But the cascarilleros did not even know that the trees bore seeds, until my inquiries called their attention to the fact. The seringueiros on the Amazon are well aware that, from the time the India-rubber trees begin to flower until the fruit is ripe, they can get little or no milk from them.

At Limon there are trees with plain leaves, and others with leaves in various degrees of crispation, a difference so slight and accidental that it cannot constitute even a variety; nor could I connect it with any variation in soil or exposure.

Trees growing in moist situations are said to have the bark more easily separable than those which grow in dry, stony places, but it also shrinks more in drying. However (and this is the most important point), the cascarilleros have not ascertained that any one of their supposed varieties produces bark superior to the others. Of far greater value is the information derived from Señor Cordovez (who has analysed the red bark collected at various altitudes), that the greater the height at which the tree grows, the larger is the proportion of alkaloïds contained in the bark.

Botanically speaking, the Red Bark varies in the breadth of the leaves, and more considerably in the degree of pubescence, although the latter, whether sparse or dense, is always the same short soft down, at once distinguishable from the longer and harsher pubescence of *C. Magnifolia*. Not to burden my report with technical details, I transfer to a supplementary note my description of *Cinchona Succirubra*, drawn up from fresh specimens.

I proceed now to give some account of the other indigenous inhabitants of the Red Bark woods, animal and vegetable.

The *Andine Bear*, chiefly inhabiting the middle wooded region, descends to the lower limit of the Red Bark. On the eastern side of the Andes it rarely goes as low as 3,000 feet.

The *Jaguar* (*Felis onça*) chiefly inhabiting the plain, does not yet seem to have climbed as high as Limon; but at Tarapoto, in the Andes of Maynas, it was abundant up to more than 3,000 feet elevation. The *Puma* or *Leon* (*Felis concolor*) exists not only in the plain, but throughout the wooded slopes of the Andes; it is only too abundant in the roots of the cordillera, and I have seen its footsteps on recent snow at a height of 13,000 feet, on the high mountains to the eastward of Riobamba. "Puma" is the Indian generic name for every sort of tiger, but the Spanish colonists limit it to the red tiger, and call the spotted jaguar "tigre." Bears never troubled our hut, but we had two nocturnal visits from the puma. On one of these occasions the puma seized and was carrying off a little dog, but a very large and fine black dog sprang on the puma, and forced him to let go his hold. By that time the Indians were on foot and running to attack the puma, who only escaped through favour of the darkness. The screams of an animal seized by a tiger are about the most doleful sounds one ever hears in the forest, and after being once heard, their cause can never be mistaken.

The *Wild Pig* (*Pocary*) frequently ascends to Limon, where there are also two or three smaller pachyderms.

Two sorts of *Monkeys* are common, one of them almost as noisy as the howling monkey, but of a different genus. I do not know of any monkey which ascends to the temperate region of the Andes.

A pretty red-headed *Parrot*, so small that it might be taken for a parroquet, arrived in immense flocks about the end of July, and took up its summer residence in the Red Bark woods. The same species abounds in the valley of Alausi, where it makes sad havoc of the maize crops, and ascends by day to 8,500 feet, but always descends to Pumacocha to roost. Along with the parrots came *Toucans*, of two species.

Snakes are very frequent, and some of them venomous. Limon seems to be the highest point to which the *Equis* ascends, a large and deadly snake which is a great pest in the plains of Guayaquil; it takes its name from being marked with crosses (like the letter "X") all along the back.

Butterflies I have rarely seen in greater number, and they include at least four species of those large blue butterflies (probably species of *Morpho*) which, on the eastern side, are seldom seen above the hot region. *Cockroaches*, too, ascend higher than I have elsewhere observed. We had four or five species in our hut,

none of them large, and one very minute species, which often damaged my fresh specimens of plants by mutilating the flowers. It is so abundant at Camaron, 1,000 feet lower down, that it fills the pease and barley meal, and renders them uneatable. *Ants* are far more frequent than in the temperate region, but less so than in the plains. *House flies* are as great a nuisance as at Ambato; and though *fleas* are not quite so numerous as in the cool sandy highlands, there were yet plenty of them (as the Spaniards say), "para el gasto."

Before treating of the indigenous vegetation, some account of the cultivated plants will aid in giving a clear idea of the climate.

The only plant grown to any extent is *Sugar-cane*, and in the Red Bark region only the small white, purple, and black varieties thrive, as they do in sheltered parts of the central valley of the Andes up to 8,200 feet, where they are sometimes exposed to slight frosts. They take two years to ripen. Half a league below Limon, and at a little over 2,000 feet altitude, the *Caña Limeña*, or Lima cane (which I take to be the same as that of Tahiti) begins to flourish, and produces thick stems 15 feet long. It ripens there in 12 months, but in the plain of Guayaquil in eight or nine months, and in the eastern roots of the Andes, as at Tarapoto, it requires no more than six months.

Maize is sparingly grown, and can only be used in a green state, on account of the destructive parrots.

Plantains thrive well, but the climate is still too cool for the large-fruited variety called "Baraganete" at Guayaquil, and "Bellaco," in Maynas. *Bananas*, or *Guinèos*, also prosper, as they do even in the temperate region. Other fruits and tubers are grown in such very small quantities as to give the cultivators only an occasional dish. The tuberiferous plants are *Yuca* (*Manihot Aypi*), *Indu* (*Caladii*, sp.), and *Arracacha* or *Zanahoria* (*Arracacha esculenta*).^{*} Two or three sorts of *Frijoles* (*Phaseoli*) are sparingly grown. *Oranges* are well flavoured, but the trees dwindle from becoming overgrown with moss. *Lemons* (from which the site takes its name) have become half wild, and such is also the case with *Citrons*. *Coffee* thrives admirably, but so little of it is grown, that our stock of the grain was mostly procured either from Guaranda, or from the deserted farm already spoken of. There are some large trees of *Aguacate* (*Persea gratissima*), planted by the first settlers, who would seem to have been fonder of gardens than the existing inhabitants, for on all the deserted sites may be seen remnants of *Coix lachryma*, *Bryophyllum calycinum*, and occasionally *Datura arborea*. *Achiote* (*Bixa Orellana*) has been copiously planted, and fruits well; on an old tree by our hut grew no fewer than 10 species of ferns.

Other plants of warm climates, which have been tried, do not flourish. *Cresantia cujete* grows, but never flowers. There is too much fog for rice; and the ears are invariably destroyed by ergot. Scarcely any of the esculent plants of the cool region thrive at Limon; potatoes, for instance, run all to leaf.

As above indicated, Limon was once entirely clad with forest, in which respect it contrasts strongly with the valley of Alausi, where the slopes on both sides are covered with grass, even down to the hot region, and only the lateral valleys and the plateaux are wooded. I cannot doubt that the difference arises from the former being situated in the roots of a snowy mountain, while there is no perpetual snow within a long distance of the latter. I have observed the same difference, referrible to the same cause, along the eastern side of the Andes. After passing the valley of San Antonio, to the southward, there is this intermixture of woods and pajonales all the way to the frontier of Peru. As would naturally

^{*} The tubers of the *Arracacha* are, to my taste, superior to all others except the potato. The flavour is most like that of the parsnip, but far more delicate. The plant, however, does not thrive in either a hot or a cold climate, and the slightest frost kills it. Its range in the Andes is almost limited to the zone between 3,000 and 7,000 feet. The finest *Arracacha* I ever ate grew at 4,000 feet. The length of time the tubers take to ripen (nine or ten months) might seem an insuperable obstacle to the cultivation of the *Arracacha* in Europe; but I would persevere until I forced it to change its "custom," as the Brazilians have done with the *Manihot*, which also ordinarily requires 10 months to ripen; but on the Soliões (or Upper Amazon) they have got a precocious variety, called "Mandiocca de tres meses," which, being planted early in the dry season on the rich alluvium left by the retiring waters, ripens its tubers before the site is covered by the next flood.

naturally be expected, the vegetation at Limon is far more luxuriant, and the abundance of ferns, especially in the narrower valleys, is in striking contrast to their scarcity at Puma-cocha. Tree-ferns, of five species, are everywhere scattered in the forest, and add a feature of beauty to the scenery, quite wanting in the valley of Alausi.

I estimate the average height of the virgin forest at Limon at 90 feet; but, as everywhere else in the tropics, there are here and there trees which stand out far above the mass of the forest. The monarch of the forest at Limon is an *Artocarpa*, which, from the leaves and from flowers picked up beneath the trees, I have little hesitation in referring to *Coussapoa*. The following are the dimensions of a tree of this species, which I found prostrate in a recent clearing: length, 120 feet, not including the terminal branches, which had been lopped off, were still 20 inches in circumference, and which would have made it at least 20 feet more. Circumference at 10 feet from the ground, 12 feet 4 inches; from that point narrow buttresses were sent off to the ground on all sides. At 25 feet, the trunk was forked, and the ramification was thenceforth dichotomous, at a narrow angle.

No other tree reaches the dimensions of the *Artocarpa*. A *Lauracea*, called "*Quebra-hacha*" (Break-axe), rises to 110 to 120 feet; its exceedingly hard wood is the usual material for the cylinders of the *trapiches*. My collection contains, unfortunately, very few of the larger trees. On the western slope of the Quitenian Andes there is a great burst of blossom at the commencement of the dry season, that is, towards the end of May, and another of less extent after the rains of the autumnal equinox; so that, as my visit fell between those two epochs, many of the trees were in the same unsatisfactory state as the Hill Bark already mentioned, and others had not yet begun to flower. Besides, I should hardly, under any circumstances, have been at the trouble of cutting down a large tree for the sake of only two or three specimens; and after we began to treat of the Bark plants, the Indians could hardly be spared for any other service.

In proceeding to give a classified list of the plants collected and observed, I shall generally limit myself to indicating their natural order. In order that my attention might not be called away from the main object of the enterprise, I collected very few (often unique) specimens of each plant. Many of them are obviously undescribed, but I have a great repugnance to speaking positively of species, unless I have been able to examine them thoroughly; and even then, for want of herbaria to refer to, I can rarely feel complete confidence in my determinations. I have, therefore, preferred putting the specimens unmutated into the hands of Sir W. J. Hooker and Mr. Bentham, who may perhaps be induced to name them. The general character of the vegetation may, however, be sketched very intelligibly with very little reference to species.

As I have no work on geographical botany by me, and am quite ignorant of the zones of vegetation into which modern botanists divide the equatorial Andes, I have been accustomed, in estimating the range of plants in altitude, to divide the whole height from the plain to the snow-line into hot, warm, temperate, cool, cold, and frigid regions, nearly in accordance with the common parlance of the inhabitants of the country. To assign precise boundaries to these regions would be as delicate, and indeed impracticable a task, as to say beyond what limits of structure a genus shall not extend, or a species vary. The hot region includes, but is by no means limited to, the plain, for there are very sultry valleys in the roots of the Andes, that of Tarapoto for instance, where, at a height of 1,200 to 1,800 feet, the heat is greater than anywhere on the Amazon. The zone occupied by the Red Bark, decidedly warm through most of its extent, is scarcely more than temperate at its upper limit. For further remarks on the climate, I must refer to the end of this Report. My estimate of the range in altitude of the families, genera, and species, must be considered to relate to only so much of the Andes as is comprised between the equator and the parallel of 7° S. lat. As I have examined some parts of the eastern roots of the cordillera between those limits, I am enabled to institute a comparison between the vegetation existing there, and that of the Red Bark woods on the western side, at corresponding elevations. But I enter into no speculations as to how such plants as *Mimosa asperata* and *Uncaria Guianensis*, which barely ascend to the commencement of the Bark region, to say nothing

of many others, such as *Craeva tapioides* and *Salia Humboldtiana*, which exist only in the plains on both sides, have ever been able to get over the cold ridge of the Andes, feeling convinced that they have never had to perform so impossible a feat, for plants are assuredly infinitely more ancient than the hills. It would be interesting, however, to ascertain the amount of variation that actually exists between individuals of the same species, growing on the Atlantic and Pacific sides of the Andes.

Sketch of the Vegetation of the Red Bark Forests of Chimborazo (alt. 2,000 to 5,000 feet.)

Gramineæ, 4*.—A good many species of this order were observed, but, as is mostly the case in the dry season, nearly all partially dried up and out of flower; besides that, even in the recesses of the forest, they were sought out and cropped by the starving animals. After the bamboo above spoken of, the arrow-cane (*Gynerium saccharoides*) is the most notable grass, and forms considerable beds, especially near streams. This species is abundant enough on low shores and islands of the Amazon, but it has nowhere spread far from the river-bank, nor (so far as I can ascertain) is it found wild on any of the tributaries of that river, but those which rise in the Andes. On the Rio Negro it is planted, like the bamboo, and a flat of it is highly prized by the possessor. On the Upper Orinoco it does not exist. Even on the Amazon it looks dwindled, and rarely exceeds 18 or 20 feet high; but on reaching the roots of the Andes of Maynas, one begins to see this noble grass in its true proportions. The poles, with which the Cucáma Indians propel their canoes against the rapid current of the Huallaga, are mostly portions of the stems of the arrow-cane. It attains its maximum of development on stony springy declivities, at an elevation of about 1,500 feet above the sea, where a forest of arrow-cane, with its tall slender stems of 30 to 40 feet, each supporting a fan-shaped coma of distichous leaves, and a long-stalked thyrses of rose and silver flowers waving in the wind, is truly a grand sight. The longest stem I ever measured was one I met a man carrying on his shoulder at Tarapoto. From that stem had been cut away the leaves and peduncle, and the base of the stem, which is generally beset by stout-arched exserted roots (serving as buttresses), to a height of one to three feet; yet the residue was 37 feet long, so that the entire length must have been at least 45 feet.

In the western roots of the Andes the arrow-cane is as abundant as in the eastern, but in the red bark woods it no longer grows so tall and robust as it does at half the altitude. In the valley of the Pastaza it struggles up to near 6,000 feet, where its stems are scarcely thicker than the finger. There it meets another *Gynerium* (as I take it to be), called by the Quitenians "*Jucu*," which grows 15 to 20 feet high, and differs from the "*Pintu*" (*G. saccharoides*) in the leaves being distributed throughout the entire length and on all sides of the stem. It grows abundantly by boggy streams, and in morasses on the cold *paramos*, and its stems, called (like those of the *Pintu*) "*caña brava*," enter largely into the fabrication of the poorer class of houses throughout the highlands. I have been unable to find its flowers, nor have I met any one who has seen them.

The other grasses accompanying the red bark comprise several of those rampant forest *Panica* which thread among adjacent branches to a height of 15 feet or more. The long internodes serve as tubes for tobacco pipes and for other similar uses. There are also two broad-leaved "*Gamalotes*" of the same genus. Of grasses frequent in the hot plains, I noted only *Dactyloctenium Aegyptiacum* and *Paspalum conjugatum*.

Cyperaceæ, 1.—This order is scarce, both in individuals and species. The half-dozen species observed belong chiefly to *Scleria* and *Isolepis*.

Araceæ, 4.—As abundant and varied as in the forests of the plains. An arborescent species, called "*Cusimin*" by the inhabitants, grows everywhere, even on hills where there is little moisture. The stems reach 10 feet, and are sometimes

* The number affixed to most of the orders indicates how many species of that order I gathered in a perfect state.

sometimes thicker than the thigh, though so soft that a very slight stroke of a cutlass suffices to sever them. The small spathes are fascicled in the axils of the leaves, but of all that I opened the contents were so injured by earwigs and other insects that it was impossible to ascertain the structure of the flowers. A little above, and parallel to the nearly amplexicaul base of each petiole, there is a row of tubercles—undeveloped roots I take them to be, as they quite correspond in position to the aerial roots of the scandent *Araceæ*. Species of *Anthurium* and *Philodendron* are frequent, and their deeply cloven or perforated leaves often assume grotesque forms. One very beautiful climbing *Aroidea*, with shaggy petioles and leaves streaked with deep violet above, purple beneath, I could never find in flower.

Cyclanthaceæ.—Three scandent species of *Carludovica*, all with bifid leaves.

Palmaceæ.—Frequent enough, but of few species. The *cadi*, or ivory palm, is everywhere dispersed, and is precisely the same species as I saw at Puma-cocha. I gathered and analysed the male inflorescence, but the stripping off the fronds for thatch is unfavourable to the development of the fruit, which I never saw in a perfect state. A very prickly *Bactris*, 20 feet high, with five or six stems from a root, grows here and there; and in shady places three or four *Geonomeæ* are frequent. The *Euterpe* grows chiefly at the upper limit of the Red Bark. A noble *Attalea* (called "*Cumbi*" and "*Palma real*") extends up the valley of San Antonio to the lower limit of the Bark region. It has a slight beard to the petiole.

Bromeliaceæ.—Many species are perched about on the trees, but none of striking aspect. The presence or absence of this family affords no indication of climate on the equator, for trees of *Buddleia* and *Polylepis*, at the upper limit of arborescent vegetation, are as thickly hung with a *Bromeliaceæ* as any trees on the Amazon.

Amaryllideæ, 2.—Both herbaceous twiners, the one a *Bomarea*, with pendulous umbels of showy flowers, calyx red, corolla white, with violet spots; an order, so far as my experience goes, entirely absent from equinoctial plains, but tolerably abundant in the temperate and cool regions of the Andes.

Musaceæ.—*Heliconia*, two species.

Zingiberoceæ.—*Cossus*, three species. This is about the highest point at which I have seen any *Cossus* or *Heliconia*, two genera frequent in the plains.

Marantaceæ.—Two or three species of *Maranta* were observed.

Orchidaceæ, 28.—Tolerably abundant, but comprising few handsome species. Most epiphytal orchids love light, and in the dense lofty forest they are rarely seen, and often inaccessible, for they grow on the upper branches of large trees, and descend to the lower branches only on the margin of wide streams, where the whole of one side of the trees is exposed to the light. At Limon, however, in ancient clearings, now become pastures, where a few trees of the primitive forest have been left, and where others have here and there sprung up, despite the treading about of cattle, the branches are laden with orchids and vacciniums; and although none of the former be of remarkable beauty, yet they are in so great variety, and there is such a charm in seeing them on the rugged mossy trees in their native woods, that to me they were always objects of interest. The finest orchid, as to its flowers, is an *Odontoglossum*, with large chocolate-coloured flowers, margined with yellow. I gathered the same species at Puma-cocha, under No. 6,072. As respects foliage, a fairy *Stelis* (*S. calodyction*, Mss.), with roundish pale green leaves, beautifully reticulated with the purple veins, far excels every other plant seen in the cinchona woods. I found but a single tuft, almost buried in moss on the trunk of a tree. An orchid (genus unknown), with thick coriaceous leaves, curiously spotted with white, a rare feature in epiphytal orchids, was discovered by Mr. Cross. Very remarkable was an *Oncidium*, with numerous peduncles, 10 feet long, twining round one another, and on adjacent plants. Besides the orchids growing on trees, a good many species, allied to *Spiranthes*, grow on the earth and on decayed logs.

The 28 orchids gathered in flower are, perhaps, scarcely a third of the whole number observed. On the slopes of the Andes some orchid or other is in

flower all through the year, and almost every species has its distinct epoch for flowering.

In the Andes, epiphytal orchids accompany trees almost to the upper limit of the growth of the latter, and some species are therefore often exposed to positive frost. In 1857 I slept one frosty night on the hill of Guambaló, near Ambato, at a height of about 9,500 feet. In the morning, when the sun came out bright and hot, I saw the maize in the adjacent fields entirely destroyed, the leaves of potatoes and nettles blackened, young shoots of many indigenous plants, even *Vaccinia* and *Gaultheria*, bleached and withered; but four epiphytal orchids (one *Stelis*, two *Pleurothallides*, and one *Oncidium*) in full flower, which had been exposed to the influence of the frost, were apparently not the least injured.

Commelynaceæ.—Three species of *Commelyna* seen, chiefly near streams and in cultivated places.

Pontederiaceæ, 1.—A small creeping plant, with white or very pale lilac flowers, probably a *Pontederia*, in springy situations by the Chasuán.

Dioscoreaceæ.—Only the male plant seen of a *Dioscorea*.

Smilacææ, 2.—Species of *Smilax*, both with roundish stems and few prickles. One of them, with large cordate leaves, is abundant, but the roots have never been collected in this locality.

Gnetaceæ, 1.—A *Gnetum* (*G. trinerve*, Mss.), apparently parasitic, and remarkable for its three-ribbed leaves. It is the first species of this genus I have seen in the hills, though *Gneta* are common enough in the plains, and especially on the Rio Negro, where the kernel of the fruit is eaten roasted.

Myricaceæ, 1.—A wax-bearing *Myrica*, which descends to 2,000 feet on open beaches of the Rio San Antonio, but was not observed by the Chasuán. The same or a very similar species grows on wide gravelly beaches of the Pastasa, Morona, and other rivers which descend the eastern slope of the Andes; and a good deal of wax is obtained from its fruit, principally by the Jibaro Indians, who sell it to traders from Quito, Ambato, &c., under the name of “Cera de laurél,” or laurel wax.

Urticaceæ, 2.—Two or three fruticose *Pilea* were observed, but the only plant gathered was a tree 25 feet high (growing by the Rio San Antonio), which seems a species of *Sponia*, a genus placed by some authors in *Ulmaceæ*.

Moraceæ.—Here and there grows a parasitical *Ficus*, but the species seemed much fewer than I have observed in other similar localities.

Apoceæ.—None gathered, although, as above remarked, the tallest tree of the forest belongs to this order. Two *Cecropiæ* are not unfrequent, and another tree with a tall white trunk and large hoary pedatifid leaves, looking quite like a species of the same genus, extends up the slopes of the mountains to 8,000 feet, and has its lower limit above that of the *Cinchona*; but as I have never seen its flowers, and as the *Cecropiæ* are apparently confined to the hot and warm regions, I suppose it may be generically distinct.

Euphorbiaceæ, 3.—The species gathered comprise an *Acalypha*, a *Phyllanthus*, and a small tree of unknown genus. There were besides two *Euphorbiæ* in the cane grounds, and a shrubby *Croton* by the Rio San Antonio.

Callitrichaceæ.—A *Callitriche*, in pools by the Rio San Antonio.

Monimiaceæ.—Three species of *Citrosma* are frequent.

Menispermaceæ.—A woody twiner of this order was noted, probably an *Abuta*, but without flower or fruit.

Cucurbitaceæ, 8.—Plants of this family are abundant, and besides the eight species gathered, some others were seen in a barren state. I gathered two *Angurice*, with trifoliolate leaves, and the characteristic scarlet flowers of the genus. One plant, apparently of this order, puzzled me much, for the woody stems, partly twining and partly climbing by means of radicles, and no thicker than packthread, bore a bunch of slender flowers (calyx scarlet, corolla yellow) near the base; but though I pulled down some stems of enormous length, I could

could see no traces of leaves on them. At length, I succeeded in getting down an entire stem, 40 feet long (by no means one of the longest), which had a couple of trifoliate leaves near the apex. A *Cucurbitacea*, called "*Cidroyota*," which only grows near houses, and has, probably, originally been sown, bears a large pyriform fleshy fruit, corrugated like the rind of a citron (whence the name), which, sliced and cooked along with meat, is very good eating. I dried seeds of it, but they disappeared, having perhaps been carried off by cockroaches.

Begoniaceæ, 4.—Two climbing and two terrestrial species. Of the latter, one is a large coarse plant ten feet high, with leaves resembling those of *Heracleum giganteum*. I have gathered the same or a very similar species on the eastern side of the cordillera. One of the climbing species is very ornamental, from its long pinnate shoots bearing a profusion of roseate flowers and generally purplish leaves. This genus, entirely absent from the Amazonian plain, though it has one representative in that of Guayaquil, abounds on the woody slope of the Andes, especially in the warm and temperate regions.

Papayaceæ.—Two species of *Carica* were seen, both slender simple arbuscules of five to six feet—the one by the Chasuán, the other by the San Antonio. The leaves of the former are boiled and eaten by the inhabitants under the name of "*col del monte*," (wood cabbage). The plants referred to *Carica* require to be carefully re-studied from fresh specimens. The large fleshy, elongate, angular green or yellow fruits of the Papaws and Chamburús look very different from the small, soft, sub-globose scarlet berries of the dwarf *Carica*, such as those of the *Cinchona* woods, and other similar ones gathered at Tarapoto, and analysis of both fruits and flowers might reveal more important differences.

Flacourtiaceæ, 1.—A small tree, probably a species of *Bonara*.

Samydeæ.—A *Casearia*, which seems to be *C. Sylvestris*, grows in some abundance, but the fruits were open and empty. This is the highest point at which I have seen a species of *Casearia*, a genus abundant in the plains, especially in woods of secondary growth.

Passifloreæ, 2.—Both species of *Passiflora*—the one a woody twiner (frequently found on the Red Bark tree), with entire leaves, smallish green flowers, and globose berries the size of a cherry; the other a beautiful arbuscule, seen only in the valley of San Antonio, where it grows from the very plain up to 2,600 feet. The slender stems, of from 8 to 14 feet, are usually simple and arched, and the large white flowers grow in small pendulous corymbs from the axils of very large elongate glaucous leaves. It belongs to the sub-genus *Astrophea*, but does not agree with either of the two species (*Passiflora emarginata* and *P. glauca*) found by Humboldt and Bonpland in the Andes.*

Crucifereæ, 2.—Apparently species of *Sisymbrium*, the one growing near streams, the other in open situations; both in very small quantity. This family is entirely absent from the Amazonian plain, nor did I find any *Crucifera* in the lower Andes of Maynas; but in ascending by the Pastaza from Canelos, I came on a *Sisymbrium* at about 3,000 feet, on stones in the mouth of the Topo, by which stream it had probably been brought down from the highlands, where *Crucifereæ* have their normal station, at from 6,000 feet to the snow-line.

Capparidaceæ.—The only species observed was a *Cleome*, a genus which extends from the plain to a great height on the wooded hills.

Sterculiaceæ.—A raft-wood tree; (*Ochromæ*. sp.), is pretty abundant. Another tree of the same order (not seen in flower) appears to be a *Chorisia*.

Büttneriaceæ, 1.—A rampant *Melochia*. *Muntingia Calaburu*, a tree found in the plains on both sides of the cordillera, grows abundantly by the Rio San Antonio, up to 2,500 feet.

Malvaceæ,

* In the "corona" of the flowers, filament and rudimentary anthers are clearly distinguishable in each process, and no doubt can remain that the corona in all *Passifloræ* is really abortive stamens.

Malvaceæ, 2.—Four or five common weeds, whereof *Sida glomerata*, Cav., is the most plentiful, comprise all that was seen of this order.

Tiliaceæ, 1.—A very handsome tree, with a slender straight trunk, reaching 60 feet, very long ramuli, large ligulate serrated distichous leaves, and terminal panicles (sometimes four feet long) of yellow flowers, scented like those of *Tilia Europæa*; it is abundant and ornamental about the middle region of the red bark. Besides this tree, another of the same order (apparently a *Heliocarpus*), growing to about 30 feet, is also frequent, especially in deserted clearings. Except these two species, I saw only a weedy *Triumfetta*, belonging to the same order.

Polygalææ, 2.—A *Monnina* and *Polygala paniculata*, L. A species of *Monnina* occurs in Maynas, at about the same altitude (a little under 3,000 feet), and this seems the lowest limit of the growth of this genus near the equator. It exists in great abundance at from 6,000 to 10,000 feet, and two or three species ascend nearly 2,000 feet higher. The *Polygala* of the bark woods is the common and almost the only species of the equatorial Andes, on whose western slopes it descends to the plain, and does not seem to ascend higher than 7,000 feet on either side, nor is it common at any elevation. When I recollect the abundance of *Polygala vulgaris* on cold English moors, I am struck with this paucity of *Polygalææ* in the Andes, and still more when I compare it with their abundance and variety on hot savannahs of the Orinoco, and in hollows of granite rocks by the Atabapo.

Sapindaceæ, 1.—A woody climbing *Serjania*, a fine plant, approaching *Paulinia* in character. A *Paulinia* with trigonous stems is frequent, and is the common substitute for rope, where much strength is not required. I saw no flowers of it and only empty capsules. There is also a *Cardiospermum*, which I have seen on both sides of the cordillera up to 7,500 feet, and this is the greatest elevation at which I have noted any *Sapindaceæ*, an order which abounds in the hot plains.

Malpighiaceæ, 1.—A twiner, with fruit too young to enable me to speak positively of the genus. Plants of this order, which constitute so large a proportion of the vegetation of the plains, diminish rapidly in number and variety as we ascend the hills, and beyond the warm region of the Andes the scantest species entirely disappear; but a *Bunchosia* (probably *B. Armeniaca*)—a tree about the size of our pear-trees—ascends high into the temperate region. On the hills which slope down to the left margin of the Pastasa, this tree grows up to 8,000 feet, and in some places forms large continuous patches, unmixed with any other tree. The edible though rather insipid drupes, as large as a peach, are exposed for sale in large quantities in Ambato and the adjacent towns, under the name of "*ciruelo de fraile*," or friar's plum. They are frequently double, in consequence of only one of the cells of the ovary being sterile, instead of two, as is usually the case, and at Baños a seedless variety is cultivated.

Ternströmiaceæ, 1.—An arbuscule, with opposite leaves and few-flowered peduncles, chiefly from axillary axils. Two species of the anomalous genus *Saurauja* form trees of about 30 feet, and are conspicuous from their abundance, from their large lanceolate serrated leaves, and axillary panicles of white flowers, resembling those of *Fragaria vesca*. One of the two, with ferrugineo-tomentose leaves, seems quite the same as I have gathered on Tunguragua up to 7,000 feet (Pl. Exs. 5,089). A *Freziera* descends on the banks of the Rio San Antonio to 2,300 feet, and the same species grows on the eastern side of the cordillera, in the valley of the Pastasa, where, however, I have not seen it lower than 4,000 feet.

Clusiaceæ, 3.—One of them, a *Clusia*, abundant and ornamental from its numerous rose-coloured flowers, but the plants nearly all males. A slender half-twining shrub, seen only in fruit, is probably a congener of a doubtful plant with similar habit, gathered at S. Gabriel on the Rio Negro. Two or three other *Clusiæ* were seen, not in flower or fruit.

Marcgraviaceæ, 1.—A *Norantea*, the same as that gathered in the Bark woods of Puma-cocha. *Marcgravia umbellata* is very abundant, and climbs to the tops of the loftiest trees.

Anonacæ,

Anonacæ, 2.—The one a *Guatteria*, rather scarce at about 3,000 feet, the greatest elevation at which I have ever observed the genus; the other a small *Anona*, also scarce, it bears an edible fruit, called "*cabeza de negro*," the size of an orange but longer than broad. This order has its chief site in the hot plains.

Ericacæ, Subordo *Vacciniacæ*, 6.—Four *Vaccinia*, one *Thibaudia*, and one *Macleania*, all epiphytal shrubs. One of the *Vaccinia*, with fleshy rose or blood-coloured leaves, densely (almost teretely) imbricated on the branches, and with slender red flowers in their axils, looked very pretty on the old trees; but the *Thibaudia* was still more ornamental, from the profusion of its large tubular flowers—calyx and corolla at first yellow, turning red after the bursting of the anthers, and persisting a long time; they unfortunately turn black in drying, so that my specimens give no idea of their beauty. In *Thibaudia* we have a remarkable example of a genus which ascends from the very plain (where, however, it is very scarce) nearly to the extreme limit of lignescient vegetation. *Euericæ*, on the contrary, according to my observations, do not descend lower than 6,000 feet, on the equator.

Amyrideæ.—Two small trees, of the genus *Iceia*, were seen in flower; and some of the tallest trees with pinnate leaves, I have no doubt, from their resinous juice, belong to the same order.

Meliacæ, 1.—A species of *Trichilia*, called "*Muruwillo*," whose bark is held as a febrifuge, barely enters the bark region at San Antonio, but does not extend up to it at Limon. A tallish tree, with pinnate leaves and very large serrated leaflets, which was putting forth large terminal panicles when I left the woods, probably belongs to this order.

Zygophylleæ, 1.—A fine tree of 40 feet, with large opposite pinnate leaves; it is closely allied to *Guaiacum*, though scarcely referable to that genus.

Podostemacæ.—The withered remains of at least three species were observed on granite rocks in the River San Antonio, and they are the first of the family I have seen in the Andes, though I have carefully sought for them in streams on both sides of the cordillera.

Oxalidacæ.—At San Antonio grow two species of *Oxalis*, both of which I have previously gathered, the one on the eastern side of the Andes near Baños, and the other at Pallatanga on the western side.

Caryophyllacæ.—A solitary species of each of the genera *Stellaria* and *Drymaria* grows very sparingly. In ascending the eastern side of the Andes, I first came on a *Stellaria* at between 2,000 and 3,000 feet. This order, frequent enough in the upper regions of the Andes, seems to exist in the plains at their base, only in the genera *Polycarpæa*, *Drymaria*, and *Mollugo*, all three very scarce on the Atlantic side, but the last-named very abundant on the Pacific side.

Portulacææ.—A *Portulaca* grows in sandy places inundated by the Rio San Antonio.

Polygonææ.—A *Triplaris*, apparently identical with that observed at Puma-cocha, and possibly distinct from *T. Surinamensis*, extends a little way into the territory of the Red Bark, and in descending from thence becomes more abundant all the way down to the plain, where it is called by the Guayaquilians "*Arbol de frios*," or ague-tree. Its presence, indeed, is a pretty sure indication of a humid site.

Amarantacææ, 1.—A woody twiner. There are besides two or three weedy plants of this order, probably species of *Telanthera*.

Chenopodeææ.—Two common weeds; one of them being the ubiquitous *Chenopodium ambrosioides*, which grows with almost equal luxuriance in the elevated central valley of the Andes, and in the plains of the Amazon and Guayaquil.

Piperacææ, 5.—Species of this order are very numerous. I saw perhaps as many as 20, belonging chiefly to the genera *Artanthe* and *Peperomia*. A very fine pepper, resembling *Artanthe eximia*, Miq., but a still handsomer plant, grows

grows towards the lower limit of the bark region. The stem is 20 feet high, slender and perfectly straight, and beset with short, distant, nearly horizontal ramuli, from which hang almost vertically the large, Pothos-like, coriaceous, shining deep blue-green leaves. A multicaul *Artanthe*, 15 to 25 feet high, springs up abundantly in the pastures, where trees of it grow at such regular distances, and are so conspicuous by their yellow-green foliage, that one would suppose them planted. Their ashes afford an excellent lye for soap. On stones by the Rio San Antonio grows a stout *Peperomia*, one to two feet high, subramose, and putting forth axillary fascicles of slender white spadices, which exhale a strong odour of aniseed. When in the midst of a dense patch of it, the scent is almost stifling, though pleasant enough at a short distance. Peppers are equally plentiful in the plains, and throughout the wooded slopes of the Andes.

Lauraceæ, 3.—All small trees, not exceeding 40 feet; but a great many more were observed, including some of the loftiest trees of the forest.

Leguminosæ. *Subordo Papilionaceæ*, 3.—And several others were observed, but either in poor state or inaccessible. Some of the lofty trees with pinnate foliage, which were not seen in flower or fruit, probably belong to this order. The commonest *Papilionaceæ* is a *Mucuna*, with herbaceous twining stems, without tendrils, and large yellow flowers. It is the first *Mucuna* I have seen in the hills, but it is equally abundant by the River Guayaquil. Five species of *Erythrina* were seen, two at Limon (one of them being the same as that gathered at Puma-cocha), and the remaining three by the Rio San Antonio. There are also two *Phaseoli*, one *Dioclea*, and another *Phaseolea* with slender spikes of small pale yellow flowers and hard scarlet seeds, of which I have not yet determined the genus. An *Indigofera*, with small pink flowers, was gathered at San Antonio, and the same is frequent in the plain of Guayaquil.

Leguminosæ. *Subordo Cæsalpinieæ*, 1.—This fine tribe, so abundant in the Amazonian plain, especially on the Rio Negro and Uaupés, where the *Swartzia*, *Heterostemonia*, *Parivoe*, &c., contest the palm of beauty with the *Vochysiaceæ*, becomes scarce the moment we enter the hills, and is very poorly represented in the Bark woods. My specimens were gathered from the only tree I saw of an obscure-looking *Cassia*. There is, however, one very fine Cæsalpinieous tree, extending up the hills to 4,000 feet, but much more abundant at 2,000 feet. The trunk grows to from 20 to 60 feet, and the branches each bear a coma of very long elegant pinnate pendulous leaves, like those of a *Brownea*. For a long time we could discover no flowers or fruit, but at length Mr. Cross found legumes and abortive flowers, which spring from the naked trunk. The small flowers are crowded on a receptacle comparable to that of a *Parkea*, but are enveloped in orbicular concave bracts, resembling those of a *Cornidia*, gathered on Mount Campana in Maynas. These characters leave me in doubt whether it be really a species of *Brownea*, but, if not, it is undoubtedly closely allied to that genus.

Leguminosæ. *Subordo Mimoseæ*, 4.—Three *Ingæ* and one *Calliandra*. Other two *Ingæ* were seen without flowers. *Mimosa asperata*, perhaps the commonest of all plants on the muddy shores of the Amazon and the River Guayaquil, struggles up the Rio San Antonio to the lower limit of the growth of the Red Bark, but never seems to flower at that elevation.

Rosaceæ, 1.—A *Rubus*, with numerous small flowers, apparently distinct from *R. Urticæfolius*, poir., which I gathered in Maynas at the same elevation (3,000 feet), and these are the lowest points at which I have observed any *Rosaceæ* near the equator; although plants of this order, especially of the tribe *Sanguisorbæ*, constitute a considerable proportion of the vegetation of the open highlands.

Hydrangeaceæ, 1.—A *Cornidia*. The same, or a very similar species of this truly Andine genus, grows by the Pastasa, on the eastern side of the cordillera, at about 4,000 feet, and other three species were gathered on Mount Campana, in Maynas, at 3,000 feet. I have never seen any *Cornidia* either above or below the warm region.

Cunoniaceæ.—A pinnate-leaved *Weinmannia*, sometimes reaching 80 feet high, is very frequent, and extends down the banks of the Chasuán to perhaps

2,200 feet. A humbler species descends nearly as low on the Andes of Maynas. On the wooded declivity of the volcano Tunguragua, *Weinmannia* constitute a considerable proportion of the vegetation, and extend upwards to at least 11,000 feet.

Lythraceæ.—A *Cuphea*, a small, weak, much-branched under-shrub, with purple flowers, grows gregariously in the pastures, generally accompanied by *Sida glomerata* and a *Stachytarpheta*. By the Rio San Antonio grow other two *Cupheæ*, one of which grows also in the valley of Alausi. This genus, abundant in the plains on both sides of the cordillera, spreads up the hills to 7,000 feet, or through the region of the Red Bark, but scarcely up to that of the Hill Barks. *Adenaria purpurata* grows by the Rio San Antonio up to 2,500 feet, and descends on its banks into the plain, the same as it does by streams on the eastern side of the cordillera.

Onagraceæ, 1.—Three species of *Jussiaea* grow by the Rio San Antonio. In the warm and hot regions this genus takes the place of *Oenothera*, which is frequent in the hills, but rarely descends below 6,000 feet. In other parts of South America, as for instance along the coast of Chili, *Jussiaea* are found inhabiting a cool climate. A single plant of a large-flowered *Fuchsia* was gathered at about 2,700 feet. A similar species occurs very rarely on the eastern side of the cordillera, at a little higher elevation. These are the only instances I know of *Fuchsias* descending so low, their favourite climate being found in the temperate and cool regions of the Andes, say from 6,000 to 11,000 feet.

Melastomaceæ, 9.—The first plant which took my attention at Limon, after the *Cinchona*, was a beautiful epiphytal *Blakea*, growing from 12 to 18 feet high, with large coriaceous leaves and large rose-coloured flowers, from which features, and from its often sitting high up the trees, it has almost the aspect of a *Clusia*. At the base of each flower is a turgid involucre, of four large, orbicular, widely and closely imbricated leaves, within which is secreted a limpid fluid. When the corolla falls away, the involucre leaves close firmly over the calyx, and do not open out, nor does the contained fluid dry up, until the globose roseate berry, the size of a pea, is quite ripe. Another singular character is the syngenesious anthers, with a minute pore at the apex of each cell, through which not a grain of pollen ever escapes, as I satisfied myself by repeated observation; fertilization being effected through the agency of minute beetles, which abound in the flowers, and eat away the inner edge of the anther cells, probably part of the pollen also. This *Blakea* is further worthy of mention for being the plant which the cascarilleros most frequently mistake for the Red Bark; for, though the leaves are somewhat smaller, yet, as they turn red ere they fall off, a dense bushy plant growing near the top of a tree looks at a distance not unlike the crown of the *Cinchona*, while (as observed above), on a view sufficiently near to distinguish the flowers and the texture of the leaves, one would rather compare it to a *Clusia*.

The remaining *Melastomaceæ* offer nothing noticeable, except the scarcity of *Miconia*, the South American genus most abundant in species and individuals, and occurring from the plain to the limits of true forest on the hills. I gathered but one species, which I refer doubtfully to *Miconia*.

Myrtaceæ, 1.—Two or three *Myrcia*, which are rather scarce. A fine *Eugenia*, called “*Arrayàn*” (but different from the *Arrayàn* of Quito), with very hard, durable wood, and exfoliating bark, grows to a tree of 60 feet or more. Two *Psidia* are frequent; the one (on the beaches by the Rio San Antonio) seems the common *Guayaba* of the temperate region; the other is a timber tree, called “*Guayaba del Monte*,” which, although of very slow growth, ultimately reaches the dimensions of the *Arrayàn*, and yields equally valuable timber.

Barringtoniaceæ.—A *Grias*, with the characteristic coma of large elongato-lanceolate leaves, seems to reach its upper limit at about 3,500 feet. It is of rather stunted growth in the Bark region, and does not flower until it gets down into the plain.

Loasaceæ, 1.—A weak branching herb with small white flowers, probably an *Ancyrostemon*. There grows also in the cane-fields a virulently stinging *Loasa*, which

which is too common a weed on the eastern side, at about 5,000 feet. This order, quite absent from the Amazonian plain, accompanies woody vegetation from about 1,200 feet up to 11,000 feet, at the least, and many of the species are climbers.

Umbelliferae, 4.—Whereof three are *Hydrocotyles*, one of them departing from the habit usual to the South American species, in putting forth erect stems of three to 12 inches from a trailing rhizome. There is also a fourth *Hydrocotyle* (*H. pusilla*, A. Rich.), distinguished by its minute leaves and scarlet fruit, which I gathered at the same elevation on the Andes of Maynas. I have nowhere seen such abundance of *Hydrocotyles* in the forest as at Limon, where they constitute a notable proportion of the ground vegetation. In moist, open situations, on the higher grounds, they are common enough. According to my observations, *Eryngium fetidum* is the sole representative of the order *Umbelliferae* in the Amazonian plain, but near Guayaquil there is also a species of *Hydrocotyle*.

Araliaceae.—Two species of the fine genus *Panax* are not uncommon.

Rubiaceae, 19.—I think I gathered every plant of this order I saw in tolerable state, but a good many more were observed; on the whole about 30. Of plants peculiar to the warm and temperate valleys of the Andes, never descending to the plain, at least in this latitude, the following may be mentioned:—*Cinchona succirubra* and *Magnifolia*, two *Hamelia* (one with larger flowers than I have seen in any other species), a *Gonzalea*, and *Rubia Relbun*. Of genera abundant in the plains and rarely climbing the hills are *Randia*, *Uncaria*, *Nonatelia*, *Faramaea*, and *Cephaelis*. *Uncaria Guianensis*, a twiner with formidable aculeiform stipules, has a very remarkable distribution. I have thrice met with it on the Atlantic side of the Andes; viz., first at Pará, near the mouth of the Amazon; secondly, towards the head of the Orinoco; and thirdly, on the hill of Lamas, in the Andes of Maynas. In each of these three localities, so widely separated, it occupies a very limited area. I again met with it about the lower frontier of the bark region, and on the rivers entering the Gulf of Guayaquil it is so abundant as to form a serious obstruction to navigation, especially in the upper part of their course, where the current is rapid, and canoes ascending the stream must necessarily keep close in shore. Of genera peculiar to the highlands, from 6,000 feet upwards, such as *Hedyotis*, not a single representative was seen. Of plants allied to *Cinchona*, the most remarkable is a fine epiphyte, resembling *Buena* and *Hillia* in the large white salver-shaped odoriferous flowers; but the seeds terminate in a long coma, like those of *Echites*; instead of in a short toothed wing, as in those of *Buena*. The habit of *Buena*, indeed, is so much that of an *Apocynaea*, that, when I gathered (near Tarapoto) my first species of that genus, I was surprised to observe the large interpetiolar stipules, and the inferior ovary. There is also a handsome tree, growing from 4,000 feet upwards, perhaps allied to *Lindenbergia*, but with a curious bilamellate crest on the apex of each segment of the corolla. I have previously gathered a congener at Tarapoto, and another on Tunguragua. Two very fine and closely allied species of the tribe *Gardenieae*, I can refer to no described genus. One of them has leaves of immense size, near a yard long, and they are aggregated at the apex of a usually simple stem, so as to give it the appearance of a palm. The moment I saw it I recollected having observed the same, or a very similar tree, near Santarem, where I could never find flowers, nor did I meet with it elsewhere on the Amazon.

Loranthaceae, 1.—A *Loranthus*, with numerous small yellow sweet-scented flowers, growing abundantly, especially on *Inga* trees. There are many other species, but no large-flowered ones.

Aristolochiaceae, 1.—Two *Aristolochia* were seen, but in a barren state. A third species, scarcely referrible to *Aristolochia*, was gathered with young flowers. None of the three was seen climbing on the red bark tree.

Lobeliaceae, 3.—One *Centropogon* and two *Siphocampyli*. One or two other species of the latter genus were seen. The only *Lobeliaceae* I have seen in the plain is *Centropogon Surinamensis*, which I gathered at the foot of the granitic mountain of Imei, at the source of the River Pacimoni.

Valerianaceæ, 1.—A slender twining *Valeriana*. This genus, absent from the plains, begins to be met with in the hills at about 3,000 feet, and extends thence to the very snow-line, going through more phases in external appearance than I know in any other genus.

Compositæ, 3.—So long as I herborised only in the plains, I could never understand how Humboldt had assigned so large a proportion of equinoctial vegetation to *Compositæ*, for, from the mouth of the Amazon to the cataracts of the Orinoco and the foot of the Andes, with the exception of a few scandent *Vernonia* and *Mikania*, and of a few herbs on inundated beaches of the rivers, the species of *Compositæ* that exist are weeds common to many parts of tropical America; nor did I meet with more than one arborescent *Composita* (*Vernonia polycephala*, D. C.) in the whole of that immense area. But in ascending the Andes, from 1,200 feet upwards, *Compositæ* increase in number and variety at every step, and include many arborescent species. About midway of the wooded region, and especially in places where the trees form scattered groves rather than continuous woods, *Compositæ* are more abundant than any other family, both as trees and woody twiners, and in the latter form extend nearly to the limit of arborescent vegetation, especially as species of the fine genus *Mutisia*; while on the rigid *paramos* no frutescent plants ascend higher than the *Chuquiraguas* and *Loricarias*; and as alpine herbs, the *Achyrophori*, *Weneriæ*, &c., reach the very snow-line. In the red bark woods *Compositæ* are plentiful, and I should estimate the number of species at near 50. The trees of this order are chiefly *Vernonia*, and they abound most in deserted clearings. During my stay a plot was again brought under cultivation which had remained desert for 12 years, during which period it had become so densely and equably clad with a *Vernonia*, whose slender white stems had reached a height of 40 feet, that at a distance it looked like a plantation. Many of the woody twiners are *Compositæ*, chiefly *Senecionidæ*, and as herbaceous or suffruticose twiners there are several *Mikania*. The young shoots of a species of *Mikania* bear very large cordate leaves, usually white over the veins and purple or violet on the whole under surface; but neither it nor the *Aristolochia* are known as “*Guaco*” to the inhabitants, who are all natives of the open highlands, and have as yet found names for few plants in the forest. Among shrubby *Compositæ* I noted some *Eupatoria* and two *Baccharides*, but no *Barnadesia*; nor among herbs any *Gnaphalium*, although on the eastern side of the cordillera the two latter genera descend nearly to 3,000 feet. *Tessaria legitima*, D. C., is abundant by the Rio San Antonio. I have come on this tree in the roots of the cordillera on both sides, by all the streams which have open gravelly or sandy beaches laid under water by occasional or periodical floods. Near Tarapoto, and by the Pastasa, in the forest of Canelos, it grows to a straight little tree of 25 feet, and often forms large continuous beds. It ascends nearly to 6,000 feet, and descends into the plain, following the shores of the Amazon, to a little beyond the Brazilian frontier, where it is diminished to a small bush.

When I arrived at Limon, a large proportion of the *Compositæ* were in flower, but there were so many other and more interesting plants in the same state, that when at length I could have turned my attention to the *Compositæ*, their flowers were mostly already shed, for which reason *Compositæ* are very inadequately represented in my collection.

Apocynææ, 2.—One *Peschiera* and one *Echites*. This order rarely ascends up out of the hot region in the Andes, and in the temperate region I have seen only a single species.

Asclepiadææ, 4.—All milky twiners. This order, like the preceding, has its principal seat in the hot region, but is by no means confined to it; for two or three slender *Cynoctona* are frequent in the cooler parts of the Andes, trailing over the hedges of cactus and agave.

Solanaceææ, 5.—In this order, also, my collection contains a very small proportion of the species existing in the Red Bark woods. Shrubby *Solana* are almost endless, and two species rise to trees. Two or three species of *Cestrum* also occur as slender trees.

Cordiaceææ, 1.—A *Cordia*, a stout sarmentose species, which threads about among the trees up to a considerable height, though it never actually twines.

Convolvulaceæ.—This order seems confined to a couple of *Ipomææ*, both occurring very rarely.

Myrsineæ, 2 (or perhaps 3).—The most remarkable of all the plants I gathered is a *Myrsinea*, though, as it grows only at from 5,000 to 7,000 feet, it barely touches the frontier of the Red Bark region. It is an arbuscule of 8 to 10 feet, bearing a coma of large long deep green coriaceous leaves, so that without flower it has quite the aspect of a *Grias*; but above the leaves there is a mass, the size of the human head, of densely packed panicles and minute flowers, all of the same deep red colour. I have not previously seen any *Myrsinea* at all resembling it in habit; but I have examined it sufficiently to state with confidence that it belongs to this order, although probably an undescribed genus.

Labiataæ, 1.—Besides the solitary species gathered, there exist two species of *Hyptis*, one of them apparently *H. Suaveolens*; but this order is always scantily represented in the forest. In cane-fields at San Antonio I saw a *Stachys* with small white flowers.

Verbenaceæ, 2.—One of them a prickly suffruticose *Lantana*, threading among the bushes up to 18 feet in height; the other a woody twiner, with pretty waxy flowers, flesh-coloured externally, but the limb purple within; it is probably a *Citharexylon*, allied to *C. Scandens*, Benth. (gathered on the Uaupés), though the habit is totally different from the arborescent *Citharexyla* which grow in the cooler parts of the Andes. A *Duranta* was noted at San Antonio. A *Stachytarpheta*, which I take to be *S. Jamaicensis*, and is known in Peru and Ecuador as "*Verbenà*," seems to follow the steps of man in the cordillera from near the plain up to 10,000 feet. At Limon it exists sparingly as a weed. Another species of the same genus, with very slender spikes and small lilac flowers, abounds in open places.

Gesneraceæ, 17.—The abundance of this family is one of the distinctive features of the Red Bark woods. One group, comprising several species, has a woody rhizome, creeping up the trees, and a few long sarmentose leafy branches. The leaves of each pair are very unequal, and the smaller one sometimes obsolete; the larger one is long, lance-shaped, and, while the rest of the leaf is green, the apex and sometimes part of the margin are stained of a deep red, so as to resemble a lance dipped in blood, whence the native name, "*punta de lanza*." The axillary flowers are comparatively inconspicuous, and they are partially concealed by large red or blood-stained bracts; they seem to vary considerably in structure in the different species, but I have scarcely examined them, and cannot, therefore, refer these plants with certainty to their proper genus. Another group, whereof two species were seen and gathered, has the long tubular corolla subtended by pinnatifid sepals, which are so densely beset with stout jointed hairs as to resemble the calyx of a moss-rose, a peculiarity which I do not find noted in any described species of this order. One of the two is a small under-shrub, with the calyx and corolla yellow; the other a slender herbaceous twiner with a scarlet calyx and a dull violet corolla. An *Achimenes*, with pretty scarlet flowers, abounds along the declivities.

Bignoniaceæ, 2.—The one a *Bignonia*, with round stems; the other an *Amphiphium*, with 6-gonous stems; both twiners. Another *Bignonia* was seen, not in flower. I saw no tree of this order, though *Tecomæ* exist both in the plain, and in the cool hill forests. I have never seen any climbing *Bignoniaceæ* at a greater elevation than about 3,500 feet, but they form a large proportion of the scandent vegetation of the hot plains.

Acanthaceæ, 9.—This order is tolerably abundant, and two under-shrubs growing about the lower boundary of the Bark region bear spikes of large handsome scarlet flowers, in appearance like those of a *Justicia*, but different in character. A *Mendozia*, with woody twining stems and umbels of small white verbenalike flowers, grows everywhere.

Scrophulariaceæ, 4.—All humble herbs, two of them species of *Herpestes*, and all rather scarce.

Of Ferns and their allies I gathered the following :—

	Species.		Species.
Equisetum - - - - -	1	Dictyopteris - - - - -	1
Lycopodium - - - - -	2	Goniophlebium - - - - -	2
Selaginella - - - - -	6	Campyloneuron - - - - -	5
Polybotrya - - - - -	1	Nipholobolus - - - - -	1
Rhipidopteris - - - - -	1	Pleopeltis - - - - -	3
Elaphoglossum - - - - -	5	Anapeltis - - - - -	3
Lomaria - - - - -	2	Dipteris - - - - -	1
Blechnum - - - - -	1	Aspidium - - - - -	5
Xiphopteris - - - - -	1	Nephrodium - - - - -	6
Gymnopteris - - - - -	1	Lastrea - - - - -	11
Tenitis - - - - -	3	Nephrolepis - - - - -	3
Adiantum - - - - -	6	Davallia - - - - -	2
Hypolepis - - - - -	1	Cyathea - - - - -	1
Pteris (including Litobrochia) - - - - -	5	Hemitelia - - - - -	1
Meniscium - - - - -	1	Alsophila - - - - -	4
Asplenium (including Callipteris, Di-		Gleichenia - - - - -	1
plazium, and Oxygenium) - - - - -	21	Trichomanes - - - - -	4
Hemidictyum - - - - -	1	Hymenophyllum - - - - -	5
Didymochlæna - - - - -	1	Lygodium - - - - -	1
Polypodium - - - - -	4		
Phegopteris - - - - -	5		
Goniopteris - - - - -	2		
		Total - - - - -	131

From these should be deducted 10 or 12 species gathered beyond the limits of the Red Bark, which will leave (say) 120 species. Within those limits the following ferns were seen, but not gathered, either because they are common throughout tropical America, or from the specimens being imperfect: *Asolla Magellanica*; *Equisetum*, sp.*; *Pteris aquilina*, var. *caudata*; *Gymnogramme calomelanos*, and another species of that genus (Pl. Exs. 4,153), which grows everywhere in the roots of the cordillera on gravelly beaches; *Cyclopeltis semicordata*, a common fern in the hot and warm regions, wherever there are rocks; a loosely pilose *Pteris*, in very ragged condition, gathered previously at Tarapoto (Pl. Exs., 4,667); a *Dicksonia*, of which I saw only young plants and old frondless trunks; several species of *Elaphoglossum*, of which the fertile fronds were shrivelled up, having been in perfection in the wet season, and two or three *Hymenophylla* in the same state; so that if we make allowance for the few species which must have eluded my search, we may safely assume that I left at least 20 ferns ungathered, and the whole number may be taken at 140, that is, of ferns existing in a space not more than four miles long by three-quarters of a mile broad, or of three square miles. Perhaps few parts of the world possess so many species of ferns growing naturally in so small an area.

The five species of tree-ferns gathered in fruit all grow in tolerable abundance, and one of them, an *Alsophila*, with a trunk 40 feet high, large stout pale green fronds, and exactly opposite pinnae, is perhaps the handsomest tree-fern I ever saw. The *Cyathea* has almost constantly, below its own fronds, a supplementary crown of numerous deep green widely arched sterile fronds of a *Lomaria*, among which spring vertically the slender pectinate fertile fronds; while the trunk is enveloped in a continuous sheath of the soft, pale, but clear green foliage of *Bartramia viridissima*, C. Müll.; the whole forming one of those lovely pictures, which only those who seek out nature in her remotest recesses are privileged to see.

This *Bartramia* was in good fruit, but the greater part of the mosses had fruited during the rainy season, and the number of species was by no means so great as one would have supposed, to see the dense festoons of moss depending from old trees. They are in main part composed of two or three species, which modern botanists would refer to *Trichypus*, of as many *Meteoria*, and of a *Frullania*. *Rhacopilum tomentosum* is frequent, as it is all through the roots of the cordillera, on both sides; and another *Rhacopilum* (*R. polythrincium*, Ms.) grows in some abundance. *Orthotricha*, common enough in the region of the

Hill

* Probably a sterile form of *E. Giganteum*. By the Rio de Tablas it grows to 12 or even 15 feet high.

Hill Barks, scarcely descend below 6,000 feet, and at Limon their place is supplied by *Macromitrium* and *Schlotheimia*, both very sparingly represented. *Hookeriæ*, so abundant and ornamental on the eastern slope of the cordillera, in the same latitude and altitude, barely exist at Limon.

Hepaticæ are rather more varied than mosses, and the genus *Plagiochila*, especially, is well represented. Notwithstanding the vast variety of *Plagiochilæ* I have gathered on the Amazon and on the eastern side of the Andes of Peru and Quito, I still found new forms at Limon. The favourite site of this genus is in the warm and temperate region of the Andes. Lower down the number of species diminishes rapidly, and higher up, towards the limit of the forest, the huge masses of robust *Sendtneræ*, *Lepidoziæ*, and in some places of *Frullaniæ*, leave little room for the delicate *Plagiochilæ*. *Lejeuniæ*, on the contrary, are hot country plants.

Of Lichens, the foliaceous species are remarkably scarce. Epiphyllous lichens, whose abundance and variety is so notable a feature of the vegetation of the Amazon, seem to attain their upper limit in the Red Bark woods. The trunks of the trees are generally too well covered with mosses to leave much room for the development of crustaceous lichens. Still a good many species exist, chiefly *Graphideæ*, and I did not notice any lichen on the Red Bark which does not grow indifferently on other sorts of trees. They present no peculiarity indicative of a tropical country, if I except the occasional occurrence of a red-fruited *Ustalia*, a genus prominent for its abundance and beauty among the epiphyllous lichens of the Amazonian plain. There is sometimes an approach to that whitening of the trees which was one of the first things that took my attention on the Amazon, where one sees trunks so completely and uniformly invested by the shining white crust of lichens (mostly *Graphideæ*) that at a little distance it might be mistaken for the epiderm.

Reserving the important subject of climate to be last discussed, I resume my narrative of operations.

In the month of July, two young men at Limon, who were owing money to Dr. Neyra, determined to go in search of Bark trees, and I offered to pay them liberally if they should find any seeds or seedling plants for me. They returned from the forest after an absence of seven days, having seen neither Bark trees nor seedlings, and the weather, they said, was too foggy and wet to renew the search with any chance of success. Nevertheless, we planned an expedition in quest of plants, which Dr. Taylor was to conduct, accompanied by two Indians to carry provisions, and a man of Limon to act as guide. But when everything was in readiness for their starting, a report reached us that an Englishman, bringing with him a number of boxes, had arrived at Ventanas. On the strength of this I immediately sent Dr. Taylor thither with horses, and he had the great satisfaction of finding the Englishman to be Mr. Cross. Ventanas, however, was so full of soldiery, and was so likely to be soon the theatre of a conflict (for the opposing army lay encamped only a few leagues lower down the river), that Dr. Taylor very wisely had the materials for the Wardian cases removed about three hours' journey up the river, to a farm called Aguacatál, where they were not likely to be molested.

Mr. Cross had had all sorts of obstacles thrown in his way by the forces that held the river, and with the greatest difficulty had found men to row his canoes, so that the distance from Guayaquil to Ventanas (which appears so short on the map) had taken him 13 days to travel. He finally reached Limon on the 27th of July, looking pale and thin from his recent illness, and from the sleepless nights passed on the river, but anxious to set to work immediately. We had no young plants for him, nor any expectation of obtaining them, but I was satisfied that cuttings would succeed, although it would necessarily be a tedious process to root them well. The owner of the *chaera* of Oso-cahuitu showed me some sprigs, cut from an old stool of red bark, which he had stuck into the ground by a watercourse four months previously, and they had all rooted well. Mr. Cross also agreed with me that the success of the process was certain, and that the question was merely one of time, which only experience could solve. After reposing the following day (Sunday), we had a piece of ground fenced in, and Mr. Cross made a pit, and prepared the soil to receive the cuttings, of which he put in above a thousand on the 1st of August and following days. He afterwards

wards put in a great many more, subjecting them to various modes of treatment; and he went round to all the old stools, and put in as many layers from them as possible; but only those who have attempted to do anything in the forest, possessing scarcely any of the necessary appliances, and obliged to supply them as far as possible from the forest itself, can have any idea of the difficulties to be surmounted. Glass was the only thing for which we could find no substitute, and to get up to Limon the glasses of the Wardian cases was not to be thought of, over roads so strait and rough, where even the surest footed beast goes on continually stumbling. So we made our frames of palm-fronds, our buckets of bamboos, and invented similar contrivances for other needful articles. The closed communication with Guayaquil was felt to be a sore obstacle, as we might have sent thither for canvass and other things required for the plants, and also for a little wine and porter for the invalids.

The mornings were always cool and sometimes dull, but at seven o'clock or so, the sun would often come out blazing hot. In the afternoons, when the fog seemed to have set in for the day, it would sometimes clear away for a brief space, and admit the scorching rays of the sun. On these occasions, and on the days of sustained heat, the only means of keeping the plants from withering was to give them abundance of water; and then there was the risk, on the other hand, of their damping off. Water was supplied to the *trapiche*, for the service of the still and for culinary purposes, by a small *acéquia* (canal) carried along the hill side from the head of a rivulet about a mile off. We had by this means generally sufficient water for our plantation, but as the *acéquia* was ill-made and protected by no fence, the cattle, roaming about, generally trod and dammed it up at least once every day, when the Indians had to seek out and repair the damaged spots. But when the supply of water failed just at the moment of one of those outbursts of sun, there was no alternative but for all hands to run with buckets down to the deep glen, where there was a considerable stream, although the steep ascent from it was very toilsome. In a few weeks the cuttings began to root, and then they were attacked by caterpillars, which also had to be combated. In short, it is impossible to detail here all the obstacles encountered, and which only Mr. Cross's unremitting watchfulness enabled him to surmount. As his labours have been crowned by success, he may perhaps give a separate account of them, which will necessarily be fuller and more accurate than any I could furnish.

The passage of troops still went on for some days after Mr. Cross's arrival at Limon. A good deal of rain had fallen in the upper woody region, and the roads were horrible. The poor beasts of burden, ill-treated and with their heavy loads ill-adjusted, had their backs worn into sores, and many of them sunk under their burdens. Wherever a beast gave in, there it was turned adrift. In the warm forest, maggots soon filled their sores and ate into their very entrails; so, after wandering about for a time, most pitiable objects, they at length nearly all died. Between Guaranda and Ventanas not fewer than 300 dead horses and mules strewed the track and the adjacent forest, and above 20 carcasses were laid within nose-shot of our hut. I set the Indians to roll them into ditches and hollows, and cover them with branches and earth, but the horrid smell turned their stomachs, and they never half performed the task. During the day, whilst we were going about, we did not feel so much inconvenience, but, when the night breeze filled our hut with the vile odour, we found it impossible to sleep. Now, I smoked awhile, and then I lay down, covering my face with a handkerchief wetted with camphorated spirit, but all in vain. When I considered the fate of those poor animals, and still more that of their unfortunate owners, from whom they had been taken by force, and who, in losing perhaps their only mule, had no means left of conveying to market the produce of their industry, and thereby supporting their families, it will not be wondered at that I cursed in my heart all revolutions. Grave, indeed, must be the motive of complaint, which a people can have against its rulers, to justify it in taking up arms to obtain redress.*

Towards

* I may here relate an incident bearing on the same subject. Whilst Dr. Taylor was bringing up Mr. Cross from Ventanas, a body of some 800 men, whose commander I had known at Ambato, arrived from Guaranda. As usual, they bivouacked at Limon, and when I turned out on the following morning, I saw my four Indians prisoners in the hands of the soldiery, and one of them, with his hands tied behind him and a rope round his body, about to be dragged off towards

Towards the end of July the weather took up, and in a few sunny days the fruit of the bark trees made visible advances towards maturity. On the 13th of August I noticed that the finest capsules were beginning to burst at the base, and on the following day I had all taken off that seemed ripe, gathering them in this way,—an Indian climbed the tree, and breaking the panicles gently off, let them fall on sheets spread on the ground to receive them, so that the few loose seeds shaken out by the fall were not lost.* The capsules were afterwards spread out to dry on the same sheets, and the drying occupied from two to ten days. The first seeds were gathered at Limon on the 14th, and the last on the 29th of August. Early in September they were all dry.

Mr. Cross sowed, on the 16th of August, eight of the seeds I had gathered; one of them began to germinate on the fourth day, and at the end of a fortnight four seeds had pushed their radicles. On the 6th of September one had the seed leaves completely developed, and by the 9th of the same month, or on the 25th day after sowing, the last of the eight seeds pushed its radicle. One of the seedlings was afterwards lost by an accident, but the remaining seven formed healthy little plants, and, when embarked at Guayaquil, along with the rooted cuttings and layers, bid as fair as any of the latter to reach India alive. He had previously sown, at Guayaquil, eight *Cinchona* seeds gathered by me in 1859, and which had remained nine months in my herbarium; even of these, four germinated, and the remaining four might possibly have grown also, had they not been carried off by mice. It is, therefore, clearly proved that well ripened and properly dried seeds do not lose their vitality for a much longer period than their excessive delicacy would lead one to suspect.

Before gathering the seeds at Limon, I had cast about to see if there were any seeds to be had elsewhere. From Camaron I learnt that the few shoots from old stools that existed in the valleys to the east and north-east of that site were all far too young to bear fruit; but I ascertained that fruit had been observed in the valley of San Antonio, on a few young trees that still existed there. After bringing up Mr. Cross, Dr. Taylor went to Guaranda to purchase provisions, and on his return I despatched him to Tabacál, a cane-farm belonging to Dr. Neyra, about a league below San Antonio. Tabacál proved still more unhealthy than Limon, and Dr. Taylor had scarcely arrived there when he was taken ill, had to bleed himself, and finally to go to Riobamba in quest of remedies.† On his return the capsules were still green, and, as there was reason to fear they might fall off without ripening, he went over to Limon to consult with me. The result of our consultation was that he should remain at Limon to assist Mr. Cross, and that I should go to Tabacál, whither I accordingly proceeded on the 12th and 13th of September. The distance is really very short, perhaps not more than 12 or 15 miles in a direct line; but there is no road thither unless by way of Guaranda, which would take four days. I followed the route already taken

Ventanas. Among the beasts of burden which accompanied the troops, this poor fellow had recognised his own mule,—his *only* mule,—as dear to *him* as Sancho's ass was to Sancho, and, with the aid of his companions, had contrived to abstract it during the night, and hide it away in the forest. In the morning the mule was missed, and my Indians were immediately denounced as the delinquents, for they had been seen handling the mule the previous evening. I confess my indignation was at that moment at the boiling point, and I wished for a hundred "Rifle Volunteers," to put the whole disorderly rabble to rout. However, I had given up half my dormitory to the colonel, and had treated him with as much hospitality as lay in my power, so that I had some right to expect he would not deny any request of mine; and, accordingly, after a short parley with him, he ordered the Indians to be released. Thus I kept my Indians, and the Indian kept his mule, which was all we wanted.

* This process was not unattended with risk to the Indian, on account of the brittleness of the branches of the Bark tree. One small tree had had so much bark stripped off near the root that it was much decayed at that part, and began to crack when the Indian attempted to climb it; so, with the consent of the owner, I had it cut down to obtain the few good capsules it bore. It was one of four shoots from a large old stool, the other three shoots having been previously cut down. Its entire length was 33 feet, and to first branch 18 feet; circumference near base, 12 inches; bark cracked longitudinally, scarcely transversely; rings too obscure to be counted.

† About the end of August, whilst Dr. Taylor was at Tabacál, seven cascarrilleros, who had obtained leave of temporary absence from military service, came to Limon, and started for the hills, between the valley of Chasuán and that of Tablas. They were absent 14 days, during which time they found but three Bark trees, the largest of which they calculated might yield three quintals of dry bark; they did not see seeds on any of them, nor had they fallen in with any young plants. They ought to have gone again to get the bark, but what with the war which still continued to rage, and the rainy weather which set in at the end of September, the trees were left to stand until another year.

taken by Dr. Taylor, namely, along the path to Guaranda as far as the crest of the first ridge, and thence down to some cane-farms on the Rio de Tablas, considerably lower than the place where we had bivouacked in the month of June. Thus far there was some sort of track, but from Tablas to Tabacál, across the high ridge separating the two valleys, there had been none until Dr. Taylor opened one with the aid of an Indian. So far as I could judge from the vegetation, Tablas is about 5,000 feet high. *Cinchona magnifolia* grows abundantly, and extends some way further up the valley; and at half a league further down, I saw two trees of *C. Succirubra*, but both unfertile.

The farm of Tabacál is at a height of 2,403 feet above the sea. The valley of San Antonio opens out there into a broad basin (evidently once a lake), but again contracts about a mile lower down, between cliffs of the same trachyte and ferruginous sandstone as exist at Limon. At the upper end of the basin, a mile and a half from the farm-house, the road from Guayaquil to Guaranda leaves the bank of the river and ascends the steep *cuesta* of San Antonio, whose foot is about 2,500 feet above the sea, coinciding remarkably with the height of the foot of the *cuesta* of Limon. The river is from five to ten yards wide, and about three feet deep, but three or four feet deeper in the rainy season, when the broad beaches, strewn with blocks and rounded fragments of granite, are inundated. Along the beaches extend straggling thickets of a *Myrica*, a *Psidium*, *Muntingia Calaburu*, *Tessaria legitima*, and several other trees and shrubs indicated in the foregoing enumeration. In little pools float a *Callitriche*, an *Azolla*, and a *Riccia*. On stones in the stream itself the scorched remains of *Podostemea* were abundant.

The Red Bark tree grows here and there in the valley, beyond the beaches, and up the *cuesta* to above the church of San Antonio.* The ground is everywhere stony, and both the site and climate are evidently less favourable than at Limon, for the Bark trees are more stunted and the fruits much more backward. There is a penetrating coolness in the wind at Tabacál and San Antonio, which the indications of the thermometer do not explain, though its effects are sensible enough, not only on man, but on other animals and on plants. Agues and slow-continued fevers prevail throughout the year, but especially in the rainy season. There are scarcely any cockroaches or house-flies at Tabacál, nor did I see or hear in the adjacent woods any monkeys, parrots, or toucans. A good many of the capsules of the Red Bark had dried up while still unripe, and of those which had ripened some had burst open during the few days that intervened between Dr. Taylor's leaving Tabacál and my arriving there; but happily very few seeds were shed, and in gathering the capsules I profited by my experience at Limon, that the seeds rarely fell out for two or three days after the capsules burst, and that the latter closed up again with the dews of night.† So by gathering the capsules at daybreak not a seed fell out, nor was there any need for the precaution (which, however, I still observed) of extending sheets whereon to receive the capsules when thrown down from the trees. I took off the first capsules at San Antonio on the 14th, and the last on the 19th of September.

I had now gathered about 2,500 well-grown capsules (without enumerating many smaller ones), namely, 2,000 from ten trees at Limon, and 500 from five trees at San Antonio. Good capsules contain 40 seeds each; in some I have counted 42; so that I calculated I had (in round numbers) at least 100,000 well-ripened and well-dried seeds. Some small turgid (almost globose) capsules contained only from two to four seeds, as large and ripe as any in the largest capsules, while other capsules of the ordinary length, but slender, proved to contain only abortive seeds, and were accordingly rejected in the drying. Had the month of July been as sunny as it is said usually to be, many more capsules would doubtless have ripened; as it was, only about one flower in ten produced ripe seeds.

I had scarcely finished drying my seeds at Tabacál, when I received the welcome intelligence that the army of General Flores had obtained possession of Guayaquil,

* Of the once large village of San Antonio nothing now remains but the church, and the few existing inhabitants of the parish are scattered about in farms.

† The placentas generally fall out along with the seeds, but they are rarely ejected by the bursting of the capsule. The old empty capsules continue to hang on, sometimes, until the trees blossom again.

Guayaquil, and that the communication between the coast and the interior was re-opened. I therefore resolved to proceed to Guayaquil, and despatch from thence a portion of my seeds by the first opportunity.

I started from Tabacál on 28th September. The road thence to Guayaquil follows the right bank of the river, as far as to where the latter is confined to a deep chasm (to avoid which some rough ground has to be climbed), and then crosses to the left bank. The descent is really very gradual, but seems more steep than it really is, because the river tosses and foams among the huge stones which impede its course. As we descended, it was interesting to mark the gradual transition to the vegetation of the hot region. Leguminous trees, so scarce in the hills, began to be frequent. A bombaceous tree (*Chorisia*, sp.) here and there adorned the forest with its numerous purple flowers. *Cinchona magnifolia* was budding for flower; it accompanied me to within 1,000 feet of the plain. Enormous figs, with a long cone of exserted roots, straddled over the decayed remains, or often only over the site of the tree which had served to support them in their infancy, and which they had strangled to death after establishing for themselves a separate existence.

At about 1,500 feet elevation, I met a *Myristica*, which by the leaves I could not distinguish from that form of *M. sebifera*, which has been called *M. Mæsa* by Poeppig, and which grows about Tarapoto, at the same altitude. A little lower down I saw the first *Neea*, and near it a *Vismia*, not one of those weedy species diffused throughout tropical America, but a handsome tree, resembling *V. uvulifera* (from the *Casiquiare*). These three genera seem rarely to ascend above the hot region.

Five leagues below Tabacál the road again passes by a broad pebbly ford, to the right bank at Pozuelos, where we drew up for the night, thoroughly wetted by a soaking shower, which had accompanied us for the last hour and a half. Pozuelos is a miserable little bamboo village, but notable for its extensive orangeries, which produce the finest fruit in Ecuador. Here the valley opens out wide, and by an almost imperceptible descent mingles gradually with the plain. The river becomes muddy, still, and tolerably deep, much like the Wharfe at Tadcaster. The vegetation is now unmistakeably tropical, and there is as noble forest around Pozuelos as I have anywhere seen. Palms are far less varied than on the Amazon, but the *Attalea* above-mentioned grows immensely tall and stout. An *Astrocaryum*, whose clustered trunks are perfect *chevaux-de-frise*, from the long flat prickles with which they are beset, is very frequent. *Mimosæ* are abundant, and so are papilionaceous twiners, among which I noted an *Ecastaphyllum*. The beautiful arborescent *Passiflora* (*Astrophe*) grows far larger than at San Antonio, and I could not help now and then stopping my horse under its stems, which here and there bent gracefully over our path, to admire the large pendulous glaucous leaves and the clusters of white flowers; but I sought in vain for ripe berries. In marshy places there are beds of rank ferns (*Lastreæ* and *Diplazia*), and in pools an *Eichhornia* and a *Pontederia*. The common weeds of hot countries begin to appear, such as *Asclepias curassavica* and *Tiaridium Indicum*, the latter of which I had not seen since leaving the Amazon.

A few leagues below Pozuelos the forest gets gradually lower, until at length we emerge on broad savannahs covered with *gamalote*, in which there are only scattered trees or distant groves of *Cratæva tapioides* and a *Cochlospermum*, and along the streams dense entangled thickets. Multitudes of fine sleek horses roam over the savannahs, but the few cows that are to be seen are very lean, the foliage of the *gamalote* being too harsh for them, although not for the horses.

Bodegas, which we reached towards night of the 29th, is a small town at the confluence of the river of Bodegas (or Babahoyo) with that of Ventanas (or Caracol), their united waters constituting what most foreigners consider the river of Guayaquil, though the natives call it merely the Rio Grande, and limit the name "Ria* de Guayaquil" to the estuary, from the mouth of the river Daule (just above the city) down to the ocean. In the rainy season, the site of Bodegas is a large lake, and only the upper storeys of the houses are inhabitable, the lower storeys being deep under water. The communication with Guayaquil (distant

45 miles)

* "Ria" corresponds to "flumen," as "rio" to "fluvium."

45 miles) is maintained by means of a small steamer, but it had been hired by the Government for the conveyance of troops, and its movements were very uncertain. I was detained until October 6th, awaiting its arrival at Bodegas, and about midnight of the same day I reached Guayaquil.

I found Guayaquil in some confusion, and crowded with people; besides the number of troops that still occupied it, there was so great an influx of visitors from the interior and from foreign ports, on account of the renewal of the commerce, which had been long suspended, that I with great difficulty found a lodging. I then immediately set to work to pack up my seeds, and to draw up a brief report, to accompany parcels of them which I had been instructed to forward to the Royal Gardens at Kew, and to Jamaica. These I despatched by the steamer for Panamá on the 14th of the same month.

Before I left Tabacal a note from Mr. Cross, brought by one of the Indians, informed me that all was going on well, but he could still give no definite opinion as to how long the plants would take to become strong enough to travel. I therefore waited as patiently as I could for further news from him, which was rather difficult to obtain, as there were no means of communicating with Limon, except by way of Guaranda. I was so cramped for room that I could not open out and arrange the dried plants I had brought with me; and as this was almost the only occupation in which I could have employed myself, I soon grew heartily sick of Guayaquil, although the place is lively enough, not only from a good deal of traffic concentrated in a small space, but from almost daily fires (to which the frail materials of which the houses are constructed render it constantly liable), from frequent earthquakes, and from occasional revolutions. On one day, the 12th of October, we had four earthquake shocks, and along the coast, as at Manta, seven shocks were felt the same day. A violent shock at 2 p.m., of October 26th, shook a good deal of plaster from the walls. It is, however, wonderful to see how far these wooden houses will bend over and rise up again. At length, in November, I heard from my companions in the forest, that by the end of the month they calculated the plants would be sufficiently rooted to travel. I therefore resolved to proceed to Aguacatal, so as to have the Wardian cases put together, and a raft constructed there in readiness to receive the plants.

On November 24th I proceeded to Bodegas. There was then no obstacle to the navigation of the river, but as almost everybody was going to a feast in a neighbouring village, I had much difficulty the following day in procuring a canoe and a couple of men to take me up to Aguacatal, where I arrived at 3 p.m. of the 27th.

For two nights previous to my leaving Guayaquil slight showers had fallen, but in the forests, in the roots of the Cordillera, a good deal of rain had already fallen, and the rivers were rising. The flow of the tide extended to only half a league above Bodegas, though in the height of summer it reaches halfway to Ventanas, or nearly to the point where the mud on the beaches begins to be mixed with small pebbles. Between Ventanas and Aguacatal there are two short rapids over gravel, and ascending still higher the stones become gradually larger and more numerous, though the river is still of considerable volume, and sufficiently open to admit of being navigated by large rafts. From about five leagues below Ventanas upwards, there is no more savannah, and there are fine cacao plantations along the riverside, but by no means continuously. Aguacatal consists chiefly of one large farm-house, and of several smaller ones scattered along the bank, so that there is quite a little colony, and, singularly enough, nearly all the inhabitants are descendants of two Chinese, brought hither from Manilla in the time of the Spaniards. Their industry is almost limited to the cultivation of cacao, and of a small proportion of coffee, but their thrifter habits enable them to live much more comfortably than the lazy descendants of liberated Africans, who constitute the majority of the squatters in the plain. The materials for the cases had been deposited at the farm-house, where I accordingly took up my residence, and from whose owner, Don Matias de la Cruz (son of one of the afore-mentioned Chinese), I received great kindness and assistance. At Ventanas I found a negro carpenter to aid me in putting the cases together, but he was used to only rough work, and to nails of the largest calibre, so that if I had not put in most of the nails with my own hands, the cases would have been split in pieces. This task occupied me two days, and I then cast about for a raft. Hands were scarce, and I found that to cut down the needful balsa trees

and bamboos, and drag them to the beach, would be a work of some time and expense; so, by Don Matias's advice, I bought of an old negro, who lived a long way higher up the river, a raft he had just completed, with the intention of selling or hiring it to some one who had cacao to take to Guayaquil. The usual price was 100 dollars (which included the pay and keep of the raftsmen on the voyage), but on my representation that my cargo would be less trouble to him than cacao, he agreed to let me have the raft for 90 dollars.

Rafts for conveying cacao to Guayaquil are denominated according to the number of *cargas* (or loads) they are made to carry. A *carga* of cacao is 90 lbs. weight at the farm, but on reaching Guayaquil the Church puts in its decimating hand, and reduces the *carga* to 81 lbs. Hence a *Balsa de cien cargas* is one made to carry 9,000 lbs. of cacao, and similarly of a *balsa* of 200 or 400 *cargas*, which last is the largest size that can navigate the river Ventanas. The raft I purchased was of 250 *cargas*, and it proved of exactly the dimensions we needed for accommodating the plant-cases, and giving us space for cooking and sleeping. It was composed of 12 trunks of raft-wood, 63 to 66 feet long, and about a foot in diameter, ranged longitudinally, so as to occupy a width of 15 feet, and kept in their places by five shorter pieces tied transversely and widely apart, extending nearly to the root end of the trunks, but leaving a considerable space free towards their point, for the convenience of working the raft. The five cross pieces were covered with bamboo planking, so as to form a floor 36 feet long by 10½ feet broad, which was fenced round with rails to a height of three feet, and the whole roofed over and thatched with leaves of *Maranta Vijao*. For carrying cacao, the fence has to be lined with bamboo boards, so as to form, with the flooring, a sort of large bin. The rope used in binding together the constituent parts of the raft was the twining stem of a *Bignonia*, nearly terete, but marked by four raised lines, overlying four deep grooves in the substance of the stem, and alternating with four shallower grooves. When the stem is twisted to enable it to be tied, it splits lengthwise along those grooves into eight strips, which, however, still pull together, and offer very great resistance to transverse fracture.*

The cases were all in readiness, and the raft brought down the river and moored in front of the farm-house, but Mr. Cross did not arrive with the plants until the 13th of December. Some difficulty had been experienced in procuring the requisite number of beasts of burden, and the making of cylindrical baskets to contain the plants had proved a tedious task; besides that, the tying up each plant in wet moss, and the packing them in the baskets, were delicate operations, which Mr. Cross could trust to no hands but his own. There had been not a few falls on the way, and some of the baskets had got partially crushed by the wilfulness of the bulls in running through the bush; but the greater part of the plants turned out wonderfully fresh. We had the cases taken down to the raft, and Don Matias lent us a couple of men to carry thither the earth, sand, and dead leaves necessary for making the soil to put in the cases. Mr. Cross put as many plants into the cases as he could possibly find room for, and only rejected a few that were so much injured by their journey from Limon that they were not likely to survive the voyage to India, the whole number put in being 637. As we might expect some rough treatment on the descent to Guayaquil, we did not venture to put on the glasses, but in their stead stretched moistened strips of calico over the cases, which seemed to answer admirably. As Mr. Cross wished the plants to be firmly established in their new residence before moving them from Aguacatal, I determined to delay our departure until the latest possible moment;

* I have long known that the strongest of all *lianas* are *Bignonias*, and I have many times trusted my life and goods to their strength. In the "*malos pasos*" of the Huallaga, canoes are dragged up the most dangerous places by means of from one to four stems of *Bignonia*, according to the size of the canoe and the weight of its cargo. I have never known the *lianas* to break, and as I have sat in my canoe, anxiously watching its slow upward progress, my only care was that the *lianas* were securely fastened to the prow, or lest the sudden bursting of a whirlpool beneath the canoe should tear them from the hands of the Indians, as they with difficulty held their way along the rocky shore.

In the Guayaquil district, as on the Amazon, the aerial roots of various *Aroideæ* and *Carludovicæ* are the common substitutes for string, but *Bignonia* stems are always preferred, wherever strength is essential. Of all the *Aroideous* roots, the strongest seem to be those of the curious genus *Heteropsis* (*Timbotitica* of the Amazon, *Támshi* of Maynas). At Limon and San Antonio, as already mentioned, the trigonous stems of a *Paullinia* supply the place of string.

moment; that is to say, so as to reach Guayaquil and fasten up the cases before the arrival of the steamer of the 28th.

During my stay at Aguacatal, I made a small collection of plants, and copious notes on the character of the vegetation; but although a comparison of the latter made at the mouth of the Chasúán, and perhaps not 150 feet above the sea-level, with those made higher up the same stream, in the region of the Red Bark, could not fail to be interesting, I omit them here, in order not to swell out further this report, already of an inordinate length. Two facts only I will mention—1st, on the broad stony beach at Aguacatal, *Salix Humboldtiana*, *Adenaria purpurata*, and *Tessaria legitima* grew together in such abundance that I could almost fancy myself still on the Amazon, about the mouth of the Huallaga, where those three plants grew together in precisely the same way; 2nd, in the woods behind Aguacatal I saw a few young trees of the *Jéve*, or india-rubber tree, which formerly abounded throughout the upper part of the Guayaquilian plain, but has now become very scarce from the barbarous custom of cutting down the trees to obtain the milk, instead of tapping them, as in Brazil. From the accounts previously given to me of this tree, I was prepared to find it something very different from the *Siphonia* of the Amazon, and a sight of it showed at once that it was an *Artocarpea*. It is said to grow to an immense tree, but the largest specimen I saw did not exceed 60 feet, and it had on it female flowers and fruit. In habit and in the structure of the involucre, it reminds me most of *Naucleopsis*. From *Brosimum* it is distinct enough by the multiflorous receptacles, but it should be compared to Aublet's *Perebea*.* The milk is nauseous, not sweet-tasted as in *Siphonia*, and it contains only 30 per cent. of pure caoutchouc. Whether from some peculiarity in the chemical constitution of the milk, or whether the same thing would take place with the *Siphonia*, I know not, but it is a singular fact, that if taken up the Andes immediately after being collected it does not coagulate there. Señor Cordovez, who has an india-rubber manufactory at Ambato, keeps the milk of the *Jéve* in hide vats in an open corridor, where it retains its fluidity for two months at the least.

After my arrival at Aguacatal the weather was occasionally showery, but the rains were evidently heavier towards the source of the river, which would suddenly rise several feet, and then rapidly lower again; so that we had to watch our raft night and day, lest on the one hand it should be carried away by the floods or the onslaughts of driftwood, or on the other hand should be left high and dry by the sudden receding of the waters. At 11 P.M. of December 22d, heavy rain came on at Aguacatal, and did not cease until 9 A.M. of the following day, when the river had risen much, and continued rising through the day; the next night still heavier rain fell, clearing off at about 8 A.M. of the 24th, which was the day fixed for starting on our voyage. Our raftsmen were three in number, as far as to Bodegas, but thence to Guayaquil, where the river is wider, and is therefore not subject to sudden rises and falls, we needed only two. As soon as the rain ceased, we got the glasses of the cases put on board, and when our raftsmen had taken their last "trago" with their friends, and said their last "Adios," (always a lengthy process) we left Aguacatal; Don Matias, at parting, foretelling us a speedy but perilous voyage.

The oars used in navigating these rafts are merely bamboos, about 20 feet long,

* Desirous of leaving the analysis of the flowers and fruits to better hands, I have not yet examined them; but I add here my notes made from the living plant, which, along with my specimens, may enable the genus and species to be correctly determined:—

Arbor 60—100 pedalis, ramis primariis secundariisque subconfertis, angulum acutum adscendentibus, pinnatim ramulosis. *Cortex* caudicis subsulcata, ramulorum cicatricibus stipularum oblique annulata. *Ramulorum* apice crescentium pars novella distiche foliosa pilis breviusculis ferrugineis pilosa. *Succus* turbide lactens copiosus sapore amaro-acrido.

Folia ejusque ramuli sub 10, petiolo brevi $\frac{1}{2}$ — $\frac{3}{4}$ unciali piloso, media $11\frac{1}{4} \times 5\frac{1}{2}$ unc. (inferiora sensim minora) elongato-oblonga acute apiculata basi profunde cordata, denticulata, dentibus singulis fasciculum pilorum gerentibus, subcoriacea, supra sparse strigillosa late viridia, subtus pallidiora ad venas elevato-reticulatas ferrugineo-pilosa; venæ primariæ sub 20-jugæ angulo 80° e costa egredientes, sensim sursum curvatae, prope marginem subito, arcuato-anostomosantes; venæ intermediae sub-quaternæ mox cum venis secundariis crebriusculis obliquis anostomosantes.

Stipulae $2\frac{3}{4} \times 1\frac{1}{2}$ unc. amplexanti-convolutivæ tenues pallidæ pilosæ deciduissimæ, venis 20 longitudinalibus a basi ad apicem usque percursoræ.

Receptacula ad axillas foliorum annotinorum (sæpius jam decisorum) sessilia, solitaria, ad *Anonarum* fructus instar squamosa, diametro semunciali, fructu aucta.

Fructus baccati in massam fere hemisphæricam concreti, aurantiaci miniativæ, insipidi.

long, half their thickness being cut away for about a yard at the outer end, so as to form a sort of scoop. Two oars were fixed in the prow, and a third oar in the stern, the latter being worked by the old black who had sold me the raft. The river had risen almost to its winter level, and we swept along rapidly. At 2 P.M. we were already eight leagues away from Aguacatal, near a site called Cataráma, below which the river is narrowed in some places to 30 yards, and the navigable channel is further straitened by the trees (chiefly species of *Inga*), which hang far over the water. Add to this that the river ran like a sluice, and that the turns were frequent and abrupt, and it will be seen how difficult it was to maintain our clumsy craft always in the mid-stream. Although the men tugged hard at their oars, they could not save us from being frequently brushed by the trees; and at length, at a sharp turn, the raft went dead on, and through a mass of branches and twiners that hung over to the middle of the river. The effect was tremendous; the heavy cases were hoisted up and dashed against each other; the roof of our cabin smashed in; and the old pilot was for some moments so completely involved in the branches and the wreck of the roof, that I expected nothing but that he had been carried away. He held on, however, and at last emerged, panting and perspiring, but with no further injury than a smart flogging from the twigs, which, indeed, none of us entirely escaped. There have been instances on this river of a man being hooked up bodily by the formidable *Uncaria Guianensis*, and suspended in mid-air, whilst the raft passed from under him.

Our deck now presented a lamentable sight, but we had little time for ascertaining the amount of damage, as at every turn a similar peril awaited us. We, in fact, twice again ran into the bush, not quite so violently as before, but each time adding to the damage already sustained. We had calculated on reaching Caracol that day, and might still have done so before nightfall, but that there were some bad turns ahead, which, as the men were already much fatigued, we could not expect to pass without very great risk; so at 4½ P.M. we brought to, with some difficulty, at a place where the bank was free from trees, and made fast for the night. We then set to work to clear away the wreck of sticks and leaves which strewed the raft, and to repair the roof, which was completed by moonlight. The cases had received only a few slight cracks, and had none of them turned over, but the leaves of the precious plants were sorely maltreated. The night was fortunately dry, but we slept little, for if the river had gone down much in the night there was great danger of part of the bank falling in and swamping the raft, and at every bit of loose earth that fell, I turned out to see if any more considerable fall was to be apprehended. The river, however, remained stationary, and early in the morning we resumed our voyage, Mr. Cross lending the aid of his strong arms to the stern oar. As far as Caracol the river continued narrow and winding, and at various points we barely cleared the bushes, but nothing more serious happened to us than the loss of a few loose cloths, which were hooked up by a pendulous mass of the *Uncaria*. From Caracol downwards the river grew wider, and the banks were less overhung with wood, so that we went on with more security. We passed Bodegas a little after noon, and continued on down the river of Guayaquil. Soon after nightfall we had got as far as to where the influence of the tide was still felt, and as it was ebbing, we profited by it to hold on our way until two o'clock of the following morning, when the flood tide obliged us to lay by. Thenceforward we got on slowly, on account of having to wait between tides; but we reached Guayaquil at noon, on the 27th, without any further accident, and I immediately went on shore and sought out a carpenter, to assist Mr. Cross in nailing laths over the soil and in fixing on the sashes. By 5 P.M. of the 28th everything was completed. The plants, thanks to Mr. Cross's tender care of them, bore scarcely any traces of the rough treatment they had undergone in their descent from Limon, and in their late voyage from Aguacatal, and the only thing against them was that they were growing too rapidly, owing to the increased temperature to which they had lately been subjected. We had the cases put on board a launch and conveyed alongside the mole, to be in readiness for embarking on the steamer which was expected that night.

The steamer we were usually entered Guayaquil, on her way from Panamá southward, at 6 to 8 P.M. of the 28th of each month, and, after taking on board the mails, &c., sailed again before daybreak. At Payta she left that part of her cargo destined for Panamá, to be picked up by a steamer from Lima, which

which passed Payta on the 1st of the month, *en route* for Panamá, but did not touch at Guayaquil. However, the Panamá steamer did not come in until the night of the 31st, all too late to catch the Lima steamer at Payta, having been detained at Panamá (as we afterwards learnt) four days, awaiting the overdue Atlantic mails. On the 30th a large goods steamer came in, which goes to and fro between Lima and Guayaquil. She was not to sail again until the 2d of January, and the plants, if sent by her, would have to remain at Payta until the 13th or 14th, when another steamer should pass from Lima to Panamá; but, as there was no alternative, we had them put on board her, and commodiously afranged on the poop-deck. I then took leave of Mr. Cross and the plants, satisfied that so long as they were under his care, they were likely to go on prosperously, and having done all I could on my part to conduct the enterprise to a successful issue. During its performance, all engaged in it had run frequent risk of life and limb; but a far greater source of anxiety to me were the *contretemps* (a few only of which have been indicated in the preceding pages) that every now and then threatened to bring our work to nought. It is difficult for those who live in a country of peace and plenty, but above all of good roads, to appreciate the obstacles that beset all undertakings in countries where none of those blessings exist. Most fervently do I desire that the experiment of forming plantations of cinchonas in the East Indian possessions of the British Crown may be successful. I have seen enough of collecting the products of the forest to convince me, that *whatever vegetable substance is needful to man, he must ultimately cultivate the plant producing it*. Whilst the demand for such precious substances as Peruvian bark, sarsaparilla, caoutchouc, &c. must necessarily go on increasing, the supply yielded by the forest will decrease, and ultimately fail. My operations in the Red Bark woods have only partially opened the eyes of the Ecuatoreans to this fact, but have in a high degree excited their jealousy, at the prospect of another nation participating in the possession of a treasure which they have not known how to preserve from deterioration and proximate destruction, but which, with a little foresight, might have been rendered an endless source of wealth to their country. The proof of this jealousy may be seen in the following extracts from a decree promulgated by the Convention of Ecuador, under date 1st May 1861:—

“THE NATIONAL CONVENTION OF ECUADOR considering,—

“1. That only three American nations possess in their forests the precious quina tree:

“2. That this territorial wealth, having been at the mercy of all kinds of speculations, has fallen into disrepute, and that those who work on it are laying waste the quina-bearing forests, both those belonging to the nation and those which are private property, without any profit either to the latter or to the public treasury,—

“Decrees:

“Art. 1. The Executive shall ordain the necessary regulations to compel those who cut down quina trees to plant, around each tree cut down, six plants or shoots of the same sort.

“Art. 2. It shall also forbid every person, whether native or foreigner, to make collections of plants, cuttings, or seeds of quina trees, and shall take the necessary precautions to prevent those articles from passing the ports and frontiers of the republic; and on those who break this decree shall impose the penalties of confiscation of the said articles, and of a fine of 100 dollars for every plant or cutting, and for every drachm of seed found in their possession.”

These are the most important provisions of the decree. Another article proposes inviting the other *two* quina-producing nations, Bolivia and New Granada (forgetting or not knowing that quina exists also in Peru), to unite with them in the prohibition; and other articles forbid the exportation of the bark itself, from which quinine is to be extracted on the spot. The whole decree is framed on the dog-in-the-manger principle, and it is needless to point out its errors in fact, and its retrograde tendency. There is no harm in sticking six branches into the ground, beneath each tree cut down, and leaving them to Providence; but it is a great mistake to suppose that so rude an expedient will suffice to maintain the bark tree, even at its present reduced rate of production, much less to restore the forests to their pristine state, or to make them what they might be.

METEOROLOGICAL REGISTER * kept at *Limon*, on the River Chasuan, on the Western Slope of *Chimborazo*, in Lat. 1° 30' S., Long. 79° 20' W., and at a Height of 2,836 Feet above the Sea.

	Barometer.		Thermometer.			WIND AND WEATHER.
	Maximum.	Minimum.	Min.	Max.	6½ p.m.	
1860:						
18 June	—	—	—	—	—	Cool easterly wind 2—6 a.m.; then clear hot sun, with very slight westerly wind until noon; afterwards calm, with dense fog till night.
19 "	27°150	—	—	—	—	☉ Cool strongish easterly wind 2—6 a.m.; rest of day calm. Day clear and hot till noon; foggy in afternoon, with gentle rain 3—5 p.m.; afterwards clear.
20 "	—	27°040	—	73	—	Cool wind 1—6 a.m. Day sunny and nearly calm. Sky almost cloudless till near noon; then about half obscured.
21 "	—	—	—	—	—	Windy before daylight. Day moderately sunny, with no fog.
22 "	27°140	27°055	—	—	—	Night and morning calm. Day sunny, occasionally overcast, with gentle cool wind till 4 p.m.; then calm and drizzling till 5½ p.m. Slight shower, 7 p.m.
23 "	27°115	—	61½	75	69½	Cold strong wind 1—6 a.m. Day clear, hot, and windy till 1 p.m.; then foggy and calm till 2 p.m.; afterwards sunny, with gentle westerly wind.
24 "	27°125	—	62	68	—	Cold strong wind 0—6 a.m. Sunny till noon; then foggy till night, with drizzle from 3 to 4 p.m.
25 "	27°105	27°075	61½	75	—	Cold wind 0—6 a.m. Sunny till noon; afterwards foggy.
26 "	27°150	27°095	61½	75½	67	Cold wind 4—6 a.m. Day sunny, with mist on hills to eastward in afternoon, but clear in valley of Limon.
27 "	—	—	60½	76	—	Windy 6—7 a.m., and occasionally through day, which was clear and hot till nightfall.
28 "	27°150	—	—	76	—	Cool easterly wind 5—7 a.m. Day clear and hot, with gentle westerly wind.
29 "	27°150	—	—	77	—	Cool easterly wind 5—7 a.m. Day clear and very hot till after 2 p.m., when fog began to come on, and towards evening passed to drizzling rain.
30 "	27°150	—	61	70	—	Cool easterly wind 5—6½ a.m. Sky clear in morning, becoming obscured towards noon. Afternoon foggy, calm, and in evening drizzling.
1 July	27°215	27°135	61	68	—	Dull and nearly calm till noon. Fog and rain 0—8 p.m. An earthquake at 9 a.m., coming apparently from northward, with a rumbling noise; then gentle undulations, lasting near a minute, and ending with a smart shock.
2 "	—	—	62	70	—	● Nearly calm; sunny till near noon, then mostly overcast, but no fog.
3 "	—	27°155	61	76	—	Cool easterly wind 6—7 a.m., then gradually gentler, and at 9 a.m. veering to westerly. Clear and sunny till 1½ p.m., afterwards foggy.
4 "	—	27°125	58¾	75	—	Clear morning, with easterly wind 6—7 a.m. Day sunny till 11 a.m., then obscured at intervals until 1 p.m.; afterwards foggy and drizzling.
5 "	—	27°120	61	70	—	Wind easterly 6½—7 a.m.; through rest of day variable. Mostly dull; foggy from 10 a.m. (partially clearing away at 2—3 p.m.) throughout.
6 "	—	27°110	62	71	—	Cool westerly (to north-westerly) wind almost throughout. Sunny till near noon, then foggy till 3 p.m.; sunny again till 4 p.m. (when greatest temperature was attained); then foggy till night.

* In offering a copy of my Meteorological Register, I have to apologise for its deficiency of information on several important points. The instruments which it was proposed to send out to me never came, and the only instruments I possessed were the Aneroid barometer above spoken of, and a thermometer, whose scale ascended only to 112°, nor was it possible to procure any others in the Andes. I felt much the want of a hygrometer, and of an additional thermometer for observing the temperature in the sun of the air and earth, and also the temperature of the streams. Mr. Cross had bought at Guayaquil a small thermometer, which served us for ascertaining the temperature of the earth, at a depth of two feet, for several days; but as he afterwards required it for regulating the temperature of his pit, these observations were discontinued. In the equatorial Andes, from 8,000 feet and upwards, a thermometer buried in the shade at the depth of a foot gives remarkably equable indications throughout the year; but such is by no means the case in equatorial plains. I supposed that by doubling the depth required at 8,000 feet, I should obtain equable results at 3,000 feet; but experiment has proved that I ought to have gone deeper; for the thermometer, buried at a depth of two feet for 12 days, varied to the extent of one degree and a half during that period.

During my travels in South America, I have been accustomed to note the diurnal maximum and minimum of the barometer, which near the equator is rendered easy by their recurrence at nearly the same hour each day. As I have never had any one to assist me in my observations, I have rarely been able to register the nocturnal maxima and minima, but the few I have noted go to show that the diurnal maximum exceeds the nocturnal by the same quantity that the nocturnal minimum exceeds the diurnal; so that the mean of all the four terms does not sensibly differ from that of either of the pairs.

After my departure from Limon, Mr. Cross continued to register the temperature and the state of the weather; but I had not time to extract more than the chief results of his observations, which I shall give consecutively with those of my own.

Meteorological Register kept at *Limon*, on the River Chasúan, &c.—*continued*.

	Barometer.		Thermometer.			WIND AND WEATHER.
	Maximum.	Minimum.	Min.	Max.	6½ p.m.	
1860 ;						
7 July	27.200	—	62½	75	—	Gentle wind 6½—7 a.m.; afterwards nearly calm. Slight fog till 7 a.m., then sunny till 11 a.m., when a slight shower, followed by a brief clear interval; afterwards foggy and showery till night.
8 "	27.150	27.125	60	74	—	Gentle cool wind in morning. Sunny till noon; foggy and showery in afternoon.
9 "	—	27.165	60	71	—	Cool wind throughout. Sunny till 11 a.m., then foggy; after 2 p.m. again nearly clear.
10 "	27.210	27.135	60	70	—	Cool variable wind 7 a.m. throughout. Mostly overclouded; flying mists on slopes, but no fog till 6 p.m.
11 "	27.215	27.175	57	66½	—	Very cold day, though calm; sunny till 9 a.m., then overcast and misty.
12 "	27.195	27.125	59	71½	—	Very gentle cool southerly (to westerly) wind throughout. Sky often overcast, but no fog to-day.
13 "	27.175	27.095	61	70	—	Very slight variable wind. Sunny in early morning, then mostly overcast, and in afternoon foggy.
14 "	27.185	27.115	59	74½	—	Cold blasts of wind occasionally from midnight to sunrise; afterwards nearly calm. Sunny till 10 a.m., then overcast till 1 p.m., and again sunny till evening.
15 "	27.210	27.145	60	75	—	Calm day. Dull and cool in morning, then sunny till noon; misty 0—3 p.m., then again sunny; windy 9—12 p.m.
16 "	27.200	27.145	59	72	—	Cold gusty wind 0—7 a.m. Sunny till 11 a.m.; afterwards misty, and towards evening foggy.
17 "	27.195	27.145	58	74½	—	Gusts of wind 0—6 a.m. Fine and mostly clear day, though sun occasionally obscured between 1 and 3 p.m. Misty after sunset.
18 "	27.175	27.110	58	75	—	☉ Morning very cold and windy. Day sunny, with flying mists about noon. Foggy after sunset.
19 "	27.175	27.115	59	71½	—	Wind slight. Dull and cold till 7 a.m., then sunny until noon. Afternoon misty, and towards evening foggy.
20 "	27.175	—	58	73	—	Calm; moderately sunny till near noon, then misty, and towards evening foggy and drizzling. Several explosions from the volcano Sangay heard this day, and at 7½ p.m. a very long one ended with a perceptible trembling of the earth.
21 "	27.175	—	59	73½	—	Gentle easterly wind in morning; sunny till 3 p.m.; then foggy till 5, when fog cleared away.
22 "	27.175	27.125	59	69	—	Gentle westerly wind throughout. Fair, but mostly dull, with flying mists occasionally in afternoon.
23 "	27.205	—	60	73½	—	Gentle westerly wind 9 a.m.—3 p.m. Sky mostly obscured by thin cloud, through which sun rarely shone; dropping at 1 p.m.
24 "	27.225	27.155	59	72	—	Cool westerly wind 9 a.m.—1 p.m. Sunny till 1 p.m., then overcast; after 5 p.m. foggy and showery.
25 "	27.205	27.135	62	75½	—	Calm; sunny till 2 p.m., then misty, and towards evening foggy and showery (smart rain on hills above Limon).
26 "	27.235	—	—	68	—	Calm and cool; foggy (with brief clear intervals) and showery throughout.
27 "	27.185	27.125	59	80½	—	Gentle westerly wind. Clear hot day.
28 "	27.185	—	62	75½	—	Nearly calm; sunny till 3 p.m.; then dull, with flying mists, and in evening foggy.
29 "	27.235	27.150	64	70½	—	Very slight wind. Foggy throughout, except a brief interval between 11 and 12 a.m.
30 "	27.250	—	61	69½	—	Calm; sunny till 8 a.m., then gradually obscured; afternoon misty, and at 4 dropping (thunder to westward).
31 "	27.195	27.125	62	76	66½	Gentle wind and clear sky till noon; then foggy and calm till night.
1 August	27.175	—	—	72	—	● Calm, mostly dull, and in afternoon foggy.
2 "	27.175	27.090	—	70½	—	Misty in morning; foggy in afternoon (heavy rain on the hills these two days).
3 "	27.155	27.095	—	71	—	Sky mostly overcast, but foggy only after 4½ p.m.
4 "	27.135	27.060	60	74½	—	Gentle cool north-westerly wind until 2 p.m.; then calm, sunny, with light cloud, till 2 p.m.; then overcast, and after 3 foggy.
5 "	27.150	27.080	60	72	—	Gentle cool westerly wind throughout. Sky mostly overcast, with light cloud; foggy 3—5 p.m.; then partially clearing away.
6 "	27.175	—	62	74	—	Calm in morning; cool (westerly, veering to southerly) wind in afternoon. Moderately sunny till 1 p.m.; then foggy, and towards evening drizzling.

Meteorological Register kept at *Limon*, on the River Chasuan, &c.—*continued*.

—	Barometer.		Thermometer.			Temp. of Earth at 2 feet.	WIND AND WEATHER.
	Maximum.	Minimum.	Min.	Max.	6½ p.m.		
1860:							
7 August	27.175	—	62	78	—	68	Cool easterly (to south-easterly) wind at daybreak, and again from 6½ to 10 p.m.; remainder of day nearly calm. Fine sunny day, with gentle rain 4—5 p.m.
8 „ -	27.240	27.175	62	78	—	68	Nearly calm; sunny till 2 p.m., then dull, and in evening rather misty.
9 „ -	27.225	27.175	61	74	—	69	Cool westerly wind from daybreak to sunset, getting up again near midnight. Clear and sunny till noon, then overcast; foggy after 2 p.m., with a shower at 4.
10 „ -	27.225	27.135	60	79½	—	69	Cool strong easterly wind 0—7 a.m.; gentle westerly through rest of day. Clear and very hot till 2 p.m., then misty till evening.
11 „ -	27.220	27.155	61	76	—	69½	Cool strong easterly wind 4—6½ a.m., then nearly calm, but again windy from 8 p.m. through night. Sunny and clear till 1 p.m., then misty till night.
12 „ -	27.225	27.170	59½	77½	—	68	Cool easterly wind 0—7 a.m. Clear and hot till 2½ p.m., then misty, and from 4—4½ drizzling fog, afterwards partially clear.
13 „ -	27.225	27.150	61	72½	—	68½	Cool easterly wind 5—7 a.m. Warm but cloudy, and after 4 p.m. foggy. (Thunder on hills to eastward in afternoon, as also yesterday).
14 „ -	27.250	27.175	64	73	—	68½	Calm day; dull and warm in morning; from 6½—8 a.m. foggy, then clear till near noon; afterwards overcast, and from 2 p.m. foggy and showery, with brief sunny intervals.
15 „ -	27.255	27.185	63	70	—	68½	Mostly overcast; foggy 7—8 a.m., and again after 2 p.m., with showers 3—4½ p.m.
16 „ -	27.260	27.185	61	71	—	69	☉ Calm through day; cool southerly wind 7 p.m. nearly through night. Fog 6½—8 a.m., then clearing away (but sky overclouded) till 2 p.m., after which misty and occasionally dropping.
17 „ -	27.235	—	61½	79	6	68½	Southerly wind, in gusts, 0—2 a.m.; south-westerly 8 a.m.—4 p.m. Clear and hot till 2½ p.m., then gradually overcast, but not misty.
18 „ -	27.205	27.175	61	75½	—	68½	Calm at daybreak, but cold westerly wind 6½—12 a.m. Sunny and hot, after 2 p.m. overcast; a shower at 4 p.m., then misty till night.
19 „ -	27.225	27.145	60½	72½	—	—	Cool strongish westerly wind 7 a.m.—2 p.m. Fine day, but with a good deal of light cloud; misty at 3 p.m., soon clearing away.
20 „ -	27.265	27.20	60½	67½	—	—	Wind slight, cool, south-westerly, varying to north-westerly towards evening. Dull day, with flying mists throughout.
21 „ -	27.225	27.175	61½	70½	—	—	Cool northerly wind 7 a.m.—12 p.m. Sunny till 8 a.m., then overcast; showers at 1 and at 3 p.m.; after 5 p.m. foggy.
22 „ -	27.215	27.160	62	77½	—	—	Cool wind, mostly westerly, but varying to northward and southward till 4 p.m.; again windy after 8 p.m. Clear and sunny till 4 p.m., then showery, and misty till night.
23 „ -	27.225	27.175	63	78½	—	—	Gentle cool westerly wind, and bright sun till 4 p.m., afterwards foggy.
24 „ -	27.245	27.180	62½	76½	—	—	Westerly wind till 6 p.m. Foggy in morning; bright sun 8—11 a.m., then foggy till 1 p.m.; sunny 1—2½ p.m., then mist and showers till night.
25 „ -	27.225	27.175	60½	78½	—	—	Strong wind 4 a.m.—4 p.m.; easterly till 8 a.m.; then westerly (varying to southerly). Fine sunny day, with mist only 5—6 p.m.
26 „ -	27.265	27.205	61½	79½	—	—	Strong south-westerly wind 8 a.m.—4 p.m. Clear and sunny till 4 p.m., then partially overcast.
27 „ -	—	—	60½	77	—	—	Puffs of south-westerly wind before daybreak (and again after sunset); cool easterly wind and clear sky 5—8 a.m., then cloudy and sultry till 6 p.m., afterwards foggy.
28 „ -	27.245	27.200	60½	80½	—	—	Cool gusty wind before daybreak; day nearly calm; very sultry; overclouded after 3 p.m.; flying mists in evening.
29 „ -	27.275	27.205	61	71½	—	—	Calm and dull, with rain, 4—4½ p.m., but from 5 to 6 p.m. clear sky and bright sun.

Meteorological Register kept at *Limon*, on the River Chasuán, &c.—*continued*.

	Barometer.		Thermometer.			WIND AND WEATHER.
	Maximum.	Minimum.	Min.	Max.	6½ p.m.	
1860:						
30 August	27.285	27.200	61	70	—	Calm till 3 p.m., then westerly wind till 6 p.m. Fog from before daybreak to 7½ a.m., then mostly dull (with drops of rain at noon) till 3 p.m., afterwards sunny.
31 „ -	27.275	27.185	63	77	—	☉ Cool northerly wind 4—6 a.m., calm till afternoon, then westerly till 4 p.m., and at 4½ p.m. southerly. Overcast till noon, then sunny till 3 p.m. Smart rain 4½—6 p.m.
1 Sept. -	27.280	27.180	—	76½	—	Cool easterly wind 4—6½ a.m., afterwards nearly calm; gentle north-westerly wind 3—4 p.m., then again calm.
2 „ -	27.275	27.220	63½	69	—	Cool westerly wind; puffs of southerly wind after nightfall. Foggy throughout, with occasional drizzle.
3 „ -	27.275	27.225	61½	70	—	Calm; showery before daybreak; sunny till 11 a.m., then dull, with flying mists and showers till evening.
4 „ -	—	27.175	63	76½	—	Cool southerly wind 3—6 a.m., then westerly till 3 p.m. Clear till 3 p.m., then slightly misty.
5 „ -	27.250	27.175	61½	72½	—	Wind cool easterly 5½—6½ a.m., then gentle westerly. Sunny till 11 a.m., then overcast; after 4 p.m. foggy; showers from 7 p.m. through night.
6 „ -	27.250	27.200	63¾	76½	—	Calm; showery before daybreak, and misty till 7 a.m., then sunny, with light clouds, throughout.
7 „ -	27.275	27.195	64	69	—	Easterly (to north-easterly) wind 6—7 a.m., then mostly calm. Rain before daylight; misty after 7 a.m., and in afternoon occasionally foggy.
8 „ -	27.275	27.185	62¾	73	—	Slight wind before daybreak, afterwards calm. Flying mists till 10 a.m., then clear, but cloudy.
9 „ -	27.225	27.140	62	70	—	Nearly calm throughout. Overcast, save a sunny interval between 10 and 11 a.m. (Fog on hills above Limon, down to 5,000 feet. Rain to eastward in evening).
10 „ -	—	—	—	—	—	Gentle westerly wind. Rain 0—2 a.m.; day warm, but mostly overcast; foggy after 2 p.m. (Thunder showers to eastward 0—3 p.m.)
11 „ -	—	—	—	—	—	Nearly calm; clear till 10 a.m., then misty till night.
						<i>Journey from Limon to Tablas.</i>
12 „ -	—	—	—	—	—	Clear hot day, with strong westerly wind in afternoon.
						<i>Tablas to Tabacál (San Antonio).</i>
13 „ -	—	—	—	—	—	Moderate westerly wind. Clear till 9 a.m., then overcast, and afternoon misty.
14 „ -	—	27.375	—	—	—	Strong westerly wind 8 a.m.—3 p.m., then calm. Sunny until wind fell, then misty.
15 „ -	27.445	27.395	60½	73	—	☉ Weather almost exactly as yesterday.
16 „ -	27.635	27.535	61	75½	—	Wind cool, easterly 6—7 a.m.; strong westerly 8 a.m.—3½ p.m., then calm. Sunny till 3½ p.m., then misty on hills.
17 „ -	27.615	27.560	63	72	—	Strong wind till 3 p.m., easterly in early morning, then westerly. Sunny till 3 p.m., then obscured (mist on hills down to 500 feet above Tabacál).
18 „ -	—	27.590	63	71½	—	Strong wind 6 a.m.—4 p.m., easterly till 7½ a.m., afterwards westerly. Sunny till 4 p.m., then overcast. Misty on hills in afternoon.
19 „ -	—	—	59½	—	—	Calm in morning; strong westerly wind 8 a.m.—3½ p.m., then calm. Sunny until wind fell.
20 „ -	27.680	27.615	60½	73	—	Calm in morning; strong westerly wind 8 a.m.—2 p.m. Moderately sunny till 2 p.m., afterwards dull, with mist on hills above Tabacál.
21 „ -	27.675	27.600	61	70	—	Cool westerly wind 8 a.m.—6 p.m., and again 7—9 p.m. Mostly overcast, after 2 p.m. misty (as on hills through day).
22 „ -	27.680	27.600	61	70½	—	Strong cool westerly wind 7 a.m.—4 p.m. Clear till 10 a.m., then overcast, and in afternoon misty on hills to within 500 feet of Tabacál.
23 „ -	27.700	27.605	61	76½	—	Strong westerly wind 7 a.m.—4 p.m., then gentler, and dying away about 8. Clear hot day, with flying mists only on hills.
24 „ -	—	27.575	61½	71	—	Strong cool wind, easterly 5½—7 a.m., then westerly till 4 p.m. Moderately warm, but with much mist on hills.
25 „ -	27.630	27.560	64	72	—	Strong westerly wind 7 a.m.—3 p.m. Moderately warm, but mist descending low on hills, and after 3½ p.m. filling valley itself.

Meteorological Register kept at Limon, on the River Chasuán, &c.—continued.

	Barometer.		Thermometer.			WIND AND WEATHER.
	Maximum.	Minimum.	Min.	Max.	6½ p.m.	
1860 :						
26 Sept. -	27·680	27·610	63	76	-	Wind easterly in morning; strong cool westerly wind 7 a.m.—4 p.m., then nearly calm. Very hot till 4 p.m., then overcast, and on slopes misty.
27 „ -	-	-	63	72	-	Mostly calm, cloudy, and after 3 p.m. foggy and drizzling.
						<i>Tabacá to Pozuelos.</i>
28 „ -	-	-	-	-	-	Westerly wind till 2 p.m., then calm. Sunny in morning, at noon overcast; rain from 2—3 p.m.
						<i>Pozuelos to Bodegas.</i>
29 „ -	-	-	-	-	-	Nearly calm till noon, then smart westerly breeze.
30 „ -	-	-	-	79	-	Calm till noon, then very gentle westerly wind. Overcast, and in evening hazy.

I subjoin a few deductions from the foregoing Register, and such additional observations as seem necessary to afford a clear notion of the climate of the Red Bark woods :—

1. *Barometer*, as observed at Limon, from June 19th to September 9th, 1861 :—

	Inches.
Mean maximum	27·207
Mean minimum	27·148
Mean of maxima and minima	27·1775
Mean daily range	·059
Entire range for the above period (viz., between 27·055 inches on June 22d, and 27·285 inches on August 30th)	·230
Greatest variation in one day (on September 1st)	·100
Least (on July 8th)	·025

The observations made at Tabacál (San Antonio) from September 14th to September 27th, give the following results :—

	Inches.
Mean maximum	27·634
Mean minimum	27·550
Mean maxima and minima	27·592

The mean daily variation of the barometer in the Amazon valley, at Barra do Rio Negro (a nearly central point), is ·111 inch, as deduced from observations made in 1851, and again in 1855, at both of which periods precisely the same result was obtained.

It is well known that at great elevations above the earth's surface the atmospheric tides become less sensible, and that as we ascend still higher they at length become imperceptible; but in ascending from the plain to the summits of the Andes, the range of the barometer at various points differs widely, not only on account of difference of altitude, but in a much greater degree from difference of soil, climate, and exposure. In the hot and comparatively dry valley of Tarapoto (alt. 1,500 feet), where the climate is a perpetual summer, the prevailing sunny weather being varied by only an occasional thunderstorm, the mean diurnal range of the barometer is near two-tenths of an inch; but I have not yet collated the whole of my observations so as to be able to state it precisely. In the equally dry plains of Ambato (alt. 8,500—9,000 feet), where reigns an almost invariable spring, and where the small quantity of rain that falls during the year descends usually in gentle showers, the mean range of the barometer is exactly one-tenth of an inch, or nearly twice as great as in the foggy Bark woods at one-third of the altitude.

2. *Thermometer*,

2. *Thermometer*, at Limon, from June 19th to December 8th,—*

Mean minimum	-	-	-	-	-	-	-	-	61½°
Mean maximum	-	-	-	-	-	-	-	-	72½°
Mean of minima and maxima	-	-	-	-	-	-	-	-	66¾°
Mean temperature at 6½ P. M.	-	-	-	-	-	-	-	-	67¾°
" " of warmest month (August)	-	-	-	-	-	-	-	-	68°
" " of earth, at a depth of 2 feet	-	-	-	-	-	-	-	-	68½°
Highest temperature observed (July 27th)	-	-	-	-	-	-	-	-	80½°
Lowest (July 11th)	-	-	-	-	-	-	-	-	57°
Entire range	-	-	-	-	-	-	-	-	23½°
Mean daily variation	-	-	-	-	-	-	-	-	10½°
Greatest (July 27th)	-	-	-	-	-	-	-	-	21½°
Least (October 31st)	-	-	-	-	-	-	-	-	3°

It will be remarked that the gradual increase in the mean temperature of the air was very nearly contemporaneous with the augmented elasticity. The warmest weather was undoubtedly between July 27th and September 26th. On clear days the maximum temperature was attained at from 2½ to 3 P. M.; but as it usually came on misty at noon, or even earlier, there was from that moment rarely any increase of heat, but, on the contrary, very often a sudden decrease. On July 15th the thermometer fell from 75° at noon to 65° at 3 P. M., a fall of 10° in three hours, which, on the equator, is sufficient to cause a sensation of great cold.

According to my own experience, on passing the equator to southward, the lowest temperature throughout the year is in the month of July, about 20 days after the summer solstice. At Limon the minimum temperature was on July 11th. At Tarapoto (lat. 6½° S.) it fell on the 9th of July in two consecutive years (1855 and 1856). In July 1857 I was at Baños (lat. 1° 35' S.); but I had no instrument wherewith to ascertain the temperature (which I felt to be intensely cold), having had to abandon all my goods in the forest, on my recent disastrous journey from Canelos. At Daule, near Guayaquil, the minimum temperature (63¾°) occurred on the 7th of July of the present year (1861).†

By collating the thermometrical observations in each month, we obtain the following results:—

Month.	Mean Minimum Temperature.	Mean Maximum Temperature.	Mean of Maxima and Minima.	Lowest Temperature.	Highest Temperature.	Mean Variation in 24 Hours.	Greatest Variation in 24 Hours.	Least Variation in 24 Hours.	Mean Temperature at 6 p. m.	Total Range during Month.
June	61½	74	67½	60½ (27th)	77 (29th)	12½	15½ (27th)	6 (24th)	68½	16½
July	60	72½	66½	57 (11th)	80½ (27th)	12½	21½ (27th)	6½ (29th)	-	23½
August	61½	74½	68	59½ (12th)	80½ (28th)	13½	19½ (28th)	6¾ (20th)	-	20½
September	62½	72½	67½	60 (16th)	80 (19th)	10½	20 (19th)	5 (30th)	68½	20
October	62	70	66	60 (21st)	74 (24th)	8	13 (24th)	3 (31st)	67½	14
November	62½	71	66½	58 (29th)	75 (30th)	8½	16 (29th)	5 (14th)	67½	17
December	62	71½	66¾	-	-	9½	-	-	67¾	-

3. *Winds*.—In mountainous countries it is difficult to ascertain the exact direction of the wind, except on the peaks and on the crests of the main ridges. In a deep narrow valley, the wind generally blows either up or down it, whatever be its direction on the adjacent summits. A similar effect takes place on narrow rivers, bordered by lofty forest; thus, on the Casiquiari, and on the upper part of the Rio Negro and of the Orinoco, the wind usually blows either up or down

* Deduced from my own observations up to 11th September, and from Mr. Cross's after that period. The temperature at half an hour after sunset, which various circumstances usually prevented me from noting, was, after my departure, constantly registered by Mr. Cross.

† In the Amazonian plain I have never seen the thermometer below 70°.

down the stream. I have, therefore, not attempted to indicate the exact direction of the wind at Limon, nor any but its more marked variations. In general at daybreak (5 A.M.) an easterly wind was blowing, which had sprung up either at midnight or in the early morning hours—rarely at three or four hours after sunset of the previous evening,—and it seldom lasted for more than an hour after sunrise. Then there was a lull for an hour or two, until the day wind got up, rarely blowing for half an hour together in any fixed direction throughout the month of June; but on the 3d of July it began to blow with some steadiness from the westward, although it did not get fixed in that quarter until July 22d, after which date the wind was westerly, as a rule, from 9 A.M. (or earlier) until the afternoon fog came on. Sometimes the westerly day wind was preceded by a calm instead of the usual easterly morning wind. Northerly and southerly winds were generally gusty and of brief duration. The direction of the wind at Limon is, doubtless, influenced by the proximity on the one hand of the snowy ridge of the Andes, and on the other hand of the hot savannahs and sandy deserts of the Guayaquilian plain, bordering on the ocean. A tract of country of considerable breadth, lying along the coast of Ecuador, from Puná to near Cape San Francisco, differs little in soil and climate from the sandy deserts on the coast of Peru, and is rarely visited by more than two or three days of gentle rain throughout the year. Every day, as this sandy plain becomes heated by the solar rays, or very often not until it reaches its maximum heat, there is a rush of cold air from the ocean; but as the prevailing wind along the Pacific coast is southerly, the westerly current that would otherwise be generated is modified into a south-westerly one. In the rainy season this phenomenon is confined to the neighbourhood of the coast, for the savannahs of the Guayaquilian plain are mostly inundated; but in the dry season, when the same savannahs become dry or even dusty flats, westerly (to south-westerly) winds prevail in the after-part of the day, over the whole plain, and far up the valleys that debouch into the plain from the cordillera, especially those which are of considerable width, and whose slopes are in great part covered with grass, which becomes brown and parched in the dry season. At Guayaquil, the phases presented by the wind on a summer's day are generally the following:—At daybreak there is a cool easterly (to north-easterly) breeze. After sunrise there is a brief lull, and then a gentle variable wind springs up, its direction being modified by two nearly equal and contrary forces, the influx of cold air from the Andes, and an opposing current from the ocean. At 3 p.m. the south-west wind begins to prevail, and comes on at first in gusts, then in a sustained current of considerable intensity. At sunset it softens for a while to a gentle breeze, but about 7 p.m. it comes on again with greater violence than before, and rarely abates before 3 a.m. of the following day. This may be taken as the type throughout the whole plain, although apt to be much modified by peculiarities of local configuration, such as savannah, or forest, or the proximity of one of those wooded ridges which intersect the plain transversely to the normal direction of the wind.

I regret that, for want of an instrument to measure the intensity of the wind in the bark woods, I can give no precise information on that head. Compared with the violent winds in the central valley of the Andes, or even with those of Guayaquil, the wind at Limon never exceeded a gentle breeze. In the valley of San Antonio it was a little stronger, and still more so in the valley of Alausi; but in the latter locality its full force was displayed only above the red bark region. A question which has much excited my attention is, up to what elevation does the westerly wind prevail on the Pacific side of the Andes? I have felt it up to 10,000 feet; and yet whenever I have passed the crest of either branch of the Andes, I have found an easterly wind blowing there. I think I have collected evidence to show that on the equator the easterly wind, due to the earth's rotation, prevails at all hours in the upper regions of the atmosphere; the principal fact which points to such a conclusion being, that when the volcano Sangay is more active than ordinary, there are showers of volcanic dust or fine ashes, throughout the Guayaquilian plain, and even far out to sea. There was a fall of volcanic dust from Sangay, at Guayaquil, in the month of June of the present year, beginning on the night of the 23d, and continuing, with brief intermissions, through the five following days. But on the 18th of July as much dust fell as on all the days together of the previous fall. The shower came on at 9 a.m., when a gentle south-westerly wind was blowing. A little later the wind veered to eastward, and blew strongly, when the dust began

began to fall thicker, appearing in the air like drizzling rain. The whole sky was obscured by a lurid purple haze, and objects at a little distance seemed enveloped in fog. In the space of two hours I collected about an ounce of dust on a cardboard measuring $2\frac{1}{2}$ square feet. A little before sunset the sky became clear, and no more dust was seen to fall; but I am informed by a gentleman of Guayaquil, that all through the year, when the weather is perfectly calm, a sheet of paper spread on the ground collects a sensible quantity of volcanic dust, recognisable by its slightly saline and sometimes sulphureous taste.*

4. *Humidity*.—On the western side of the Quitoian Andes, south of the equator, the summer or dry season is considered to commence on the 1st of June, and to end on the 31st of December, the remaining five months constituting the winter or wet season. As we advance to the northward of the equator those seasons become reversed, so that the rainy season at Panamá, for instance, coincides nearly with the dry season at Guayaquil, and the steamers which run between Guayaquil and Panamá encounter winter at one extremity of each trip, all through the year. On the eastern side of the cordillera, from the equator southwards, the wet season is certain to last from March until November, and even the remaining months are in some years so rainy that there is no really dry weather throughout the year. The climate of the central valley is modified by this opposition of seasons to east and west of it, as also by the nature of the soil, and the greater or less proximity of snowy peaks; so that, in proceeding along it, we find a different climate (as relates to the phases of humidity and dryness) at every few leagues. We have now, however, to sketch only the general character and the more marked phases of the dry season in the Red Bark woods of Chimborazo.

The days on which there was neither mist, fog, nor rain at Limon, between the 18th of June and the 8th of December, were only the following:—†

June 20, 21, 26, 27, 28.

July 2, 10, 12, 14, 27.

August 17, 26, 31.

September 1, 12, 14, 17, 19, 20, 21, 23, 24, 25.

October 14, 15, 23, 24.

November 29, 30.

December 1, 2.

Although there were but three days in August in which there was no visible moisture in the lower atmosphere, yet the days were generally clear and sunny until a later hour, and there was more sustained heat than in the previous months. The formation of cloud in the Bark woods on those days when the upper

* Sangay is perhaps the most active volcano on the face of our globe. Since the day when it was first seen by the Spaniards (now more than 300 years ago), it has been in continual eruption, whereas most other volcanoes have had their periods of repose; but as it stands in the midst of uninhabited forest (for the village of Macas is at least two days' journey away), its eruptions rarely cause any damage to the dwellings of men. Its position is in the eastern cordillera, in latitude about 2° S., longitude $78^{\circ} 33'$ W. It is crowned by a great breadth of perpetual snow, or rather of alternating layers of snow and ashes, and even, it has been asserted, of modern trachyte. In the adjacent parts of the central valley of the Andes, as, for instance, at Riobamba, its explosions are rarely and indistinctly audible; but as we descend the forest-clad slope of the western cordillera, and especially when we reach the plain, they are clearly heard. At Bodegas, although distant 80 geographical miles in a direct line, the reports are so loud and distinct that they often cause people to start who have been accustomed to hear them every day of their lives. The sound is more like the roar of cannon than that of thunder, though easily distinguishable from both after a little experience. The explosions are ordinarily from one to two hours apart, rarely at intervals of only a quarter of an hour, though I have a few times heard two explosions within five minutes. At Guayaquil they are distinctly heard, although above 100 miles away; and I am assured that the sound not unfrequently reaches the very coast, at a distance of $2\frac{1}{2}$ degrees of longitude from the volcano.

† It will be noted that I have used the term "mist," when, although the air was filled with visible vapour, the evaporation was still so great that there was no sensible deposition of dew; but when the vapour was denser, and moistened objects in contact with it, I have called it "fog." There was, of course, no precise limit between those two phases; and as mist passed into fog it was curious to stand in the forest, and remark how some trees were already dripping whilst others remained dry. Generally, condensation takes place earliest on smooth shining leaves, and latest on hirsute or tomentose leaves; but considerations of this nature will by no means explain all the variations observed; and there can be little doubt that every plant has its peculiar temperature, necessary to be taken into account in studying the phenomena of its existence.

upper atmosphere was tolerably clear, was usually on this wise. Five leagues below Limon, and on the farther side of the valley of Camaron, a long wooded hill, rising to about 6,000 feet, shuts up the view to the westward, down the valley of the Chasuán. As the sun declined from the meridian, mist began to form on the eastern declivity of this hill, and went on increasing in volume until its projecting margins were caught by the westerly wind, and carried up the valley. At the same time a similar process was going on about and above Limon, on all those slopes which the sun's rays no longer reached, or on which they fell very obliquely. As the day wore on, the mist continued to increase and to descend lower and lower, until it sometimes reached Limon at the same moment as the mist from below. But whether the valley were filled entirely with mist blown up from the hill of Camaron, or in part from the lowering of the stratum of visible vapour to the altitude of Limon, that event was always the signal for the dropping of the westerly wind, the refrigeration of the atmosphere stopping the draught up the valley; but when during the night the general easterly wind resumed its suspended sway, it gradually swept away the mist, so that there was usually none at sunrise. The afternoon mist generally enveloped our hut, and extended some distance lower down the valley. At Tabacál, on the contrary, it often hung a few hundred feet above the farm. By observations at these two points, I deduce that the average height of the base of the evening cloud on the flanks of this part of the Andes is about 2,500 feet.

When I ascended the Quitenian Andes from the eastern side, and reached the central valley, whose medium height is about 9,000 feet, I saw, not without surprise, the clouds hung as high overhead as they had been in the Amazonian plain which I had lately left. In the Andes there are two distinct and often simultaneous formations of cloud, in consequence of there being two sets of condensing surfaces, the snowy summits and the wooded slopes. The space between the snow and the forest forms a zone whose perpendicular breadth varies from 3,000 to 8,000 feet, its lower limit being often far below the absolute upper limit of forest, in consequence of the nature of the soil forbidding any continuous growth of trees. Nearly the whole of the central valley is comprised in this zone, and the loose volcanic sand which prevails in many parts of it (as at Ambato and Riobamba) gets heated by the sun to a greater degree than even the white beaches of the Amazon and Tapajoz; so that there is rarely any formation of mist, and between sunrise and sunset the snow-clouds nearly always float at a vast height above the valley; while, on looking down from it to the eastward, we may see the forest clouds spread out below our feet.

During the time I remained in the Bark woods, say from about the summer solstice to a little after the autumnal equinox,* there was no heavy or long-continued rain; but on the hills, at a few thousand feet above us, heavy rains, mostly accompanied by thunder, were frequent. From July 24th to August 2d it rained heavily there every day.† There is a rainy zone on the flanks of the cordillera, where as a rule rain may be expected every day in the year; but I can do little more here than merely indicate the fact of its existence. Its limits vary with local configuration, and with the proximity of a snowy mountain, or the contrary; but to determine them on any parallel would require a long series of observations. On the western declivity of Chimborazo this rainy zone would seem to extend from 5,000 to 9,000 feet altitude, and the maximum of humidity is, perhaps, about midway of it, or at about 7,000 feet. Throughout the wooded slopes of the Andes, fogs or gentle showers may occur at any altitude, in the midst of the finest weather; and even in the plain, when (in proceeding from the coast) we reach the point where forest begins to prevail over savannah, there are occasional slight showers in the dry season, although fog is very rare until reaching about 500 feet elevation. At Guayaquil itself, during the same period, two or even three months may pass without a drop of rain falling. In this respect the climate of Guayaquil contrasts notably with that of Pará, where, throughout the dry season, a thunder shower at 2 p.m. is expected every day.

In the western cordillera, and in the plains at its base, south of the equator, the continuity of the dry season is broken by a rainy fit commencing a few days after

* It will be understood that I speak of those epochs as they occur in the north temperate zone.

† At Guaranda, situated in a wide grassy valley to the eastward of these rainy woods, and at only a short distance from them, not a drop of rain fell during that period.

after the autumnal equinox, and called by the inhabitants "*el Cordonazo de San Francisco* (St. Francis's Girdle).^{*} I have happened to be travelling in the western cordillera at that epoch in three consecutive years, viz., 1858, 1859, and 1860. In the year 1858, the weather began to be broken on the 22d of September, but the heaviest rains (accompanied by violent thunder) were from 28th September to 1st October—precisely the four days which I spent in passing from Riobamba to Pallatanga. In 1859, the rains came on on 28th September, when I was on my way from Guataxi (in the valley of Alausi) to Riobamba, and continued till 8th October. They were heavy in the forests and on the *paramos* (where the snow lay down to 12,000 feet), but in the central valley there were only gentle showers. In 1860, at the same epoch, I descended from San Antonio to Guayaquil, and the rains began the day I started (28th September). At Bodegas the sky was overclouded and the weather showery from 30th September to 5th October. At Guayaquil the *cordonazo* was represented by heavy rain on the 3d and 4th of October.

At Limon it came on to rain heavily on the 26th of September, nor did the weather ever fairly take up again after that period, as may be seen by the following *résumé* of the observations made by Mr. Cross, from the 12th of September to the 8th of December:—

Weather mostly fair, though misty or foggy in the afternoon, till past the equinox. On the 26th the rains came on, and from that date until the 13th October the mornings were cloudy, sometimes foggy, and the afternoons rainy (rarely merely foggy), the rains being heavy, and sometimes lasting all through the night.

The 14th and 15th of October were fine days, clear of fog, but from thence to the end of the month and until the 28th of November, though the mornings were usually clear and sunny, the sky became overclouded before noon, and in the afternoons there was either rain or dense fog.

The 29th and 30th of November, and the 1st and 2d of December were clear, hot days; 3d and 4th of December were tolerably fine days, though misty towards evening; on the 5th there was fog and rain in the afternoon, and on the 6th, 7th and 8th the day was foggy throughout.

I have thus sketched, as intelligibly as my materials will allow, the summer or dry season in the Red Bark woods of Chimborazo for the year 1860, and the question naturally arises, "If such were the dry season, what must the wet season be?" The answer, as I received it from the settlers at Limon, is that, whereas in the summer the early part of the day is often sunny, in the winter it is usually foggy, and that the fogs of the afternoon and night in summer are represented by heavy rains in winter. They added that, after a night of unusually heavy rain, the following day was sometimes sunny until noon. When I reached Limon, I saw evidence in the quantity of partially dried-up mud, and in the deep *camellones*, that the winter rains must have been severe. Still Limon is decidedly drier than the forest of Canelos, at the same altitude and on the same parallel, on the eastern side of the Andes, which is surely the point of maximum humidity on the face of this globe, and where the very trees seem to serve no other purpose than to hang ferns and mosses on.

The type of the rainy season at Guayaquil seems to be as follows:—In the month of November slight showers begin to fall occasionally, but it is not until about 10 days after the solstice that heavier rains come on, and winter is considered to have fairly commenced. As the ground becomes moistened, the sea breezes abate, and there is more sustained heat, though the maximum temperature each day is, perhaps, scarcely equal to that of the finest summer months. Still, all through January and well into February the quantity of rain that falls is not great; the showers are heavy, but of brief duration, and two or three fair days together occasionally intervene. March is the rainiest month in the year, and April is often very little drier. In May the rains begin to abate, and towards the

^{*} St. Francis's day is the 4th of October. Throughout South America, the periodical alternations of dry and rainy weather are laid to the account of those saints whose "days" coincide nearly with the epochs of change. But if the weather be rainy when it ought to be fair, or if the rains of winter be heavier than ordinary, the blame is invariably laid on the moon. One would think that, *en revanche*, any occurrence of fair weather, when rainy weather had been expected, would be placed to the credit of the same planet, but such is not the case.

the end of the month there is rarely more than an occasional slight shower, so that after the 1st of June there is usually unbroken dry weather.

The last rainy season has, however, shown marked deviations from the above type. The rainiest part of the season occurred at its customary epoch, namely, from 26th February to 30th March, and the most terrific thunderstorm of the whole winter was on the night of 22d March. But the last day of March was clear and hot, without a drop of rain, and all through April there was fine sunny weather, with very rarely a gentle shower, so that summer seemed to be setting in two months before its time, and the farmers began to fear a season of excessive drought. However, at eight p.m. of the 30th of April, heavy rain came on, and did not abate until sunrise the following day. Thenceforth, nearly throughout the month of May, the weather was wet, though the rains were less violent than in March, and rarely accompanied by thunder. On the 27th of May the weather again took up, that day and the next being quite fair, although up to 28th June there was frequently drizzling rain; so that, by the prolongation of the wet season beyond its usual period, the equilibrium was restored, and on the whole an average amount of rain was considered to have fallen.

NOTE ON *CINCHONA SUCCIRUBRA*, Pavon, and some allied Species.

Chinchona succirubra, Pavon:—

Hab.—In sylvis primævis cordilleræ occidentalis Andium Quitensium, præcipue ad radices montis nivosi *Chimborazo*, alt. 2,000—5,000 ped. Angl. (610—1520 metr.) supra mare.

Descr.—*Arbor* pulcherrima, 50—80 pedalis; caudice recto circumferentiâ 4-usque ad 10-pedali; comâ symmetricâ elongatâ, ramis infimis longioribus deinde superioribus sensim decrescentibus paraboloidæ, vel ramis infimis iis proxime sequentibus sub-brevioribus ovoideâ.

Cortex, caudicis ubi lichenibus non obvelatus est fuscobadius, haud profunde longitudinaliter rimosus, demum etiam rimulis transversalibus fissus; ramulorum annotinorum rufescens, novellorum e viridi cinerascens secus apicem rubescens.

Succus écoloratus, cortice autem inciso, in lucem aeremque susceptus exinde sæpius albescit, postea sensim rubescit.

Rami decussati, angulo 50°—80° adscendentes, teretes, e foliorum stipularumque cicatrisibus annulati; novelli tamen tetragoni foliosi fragiles succosi, pube brevi deciduâ densiuscule vestiti.

Folia opposita decussata, cujusque ramuli 4—6 paribus contemporalibus, cujusque paris inter se subæqualia raro valde inæqualia, sæpe perfecte ovalia, secus paniculas ovato-ovalia, raro rotundato-ovalia, basi in petiolum sensim abrupte attenuata, apice abrupte acuta vel levissime acuminata rarius rotundata, nitida subcoriacea (fragilissima tamen) læte viridia ad luteum potius quam ad cœruleum vergentia, ætate tota sanguinea, suprâ sparse decidue puberula et inter venas plus minus bullato-elevata, subtus pubescentia, raro in utraque facie glabrata; venis 11—12 cujusque lateris, angulo 56°—59° cum costâ tereti (siccando complanatâ) efformantibus, subtus prominulis, â costâ ultrâ medium rectis dein sensim incurvantibus et prope marginem anastomosantibus; petiolo tereti, e folii laminâ decurrente suprâ lineis duabus parum elevatis percurso, tomentello. Folia ramulorum tenuiorum nonnunquam ovali-vel etiam obovato-lanceolata.

Stipulæ interpetiolares deciduæ erecto-patulæ ligulato-oblongæ obtusæ ad costam carinatæ, basi subventricolæ superne explanatæ, reticulato-venosæ, sub-puberulæ, juniores pallide virides, adultiores basi roseæ vel etiam totæ sanguineæ.

Pedunculi ex axillis foliorum superiorum minorum lanceolatorum (etiam ad bracteas lineari-lanceolatas subulatasve redactorum) orti, subinde paniculam elongatam pedalem vel etiam sesquipedalem efformantes, tomentosi, bis terve decussatim pinnati dein trichotomi; divisionibus basi bracteatis sæpe indistincte oppositis

oppositis v. plane alternis. *Pedicelli* calycesque basi bracteolis minutis rigidis sanguineis ovato-lanceolatis basi utrinque unidentatis suffulti.

Calyx parvus dense appresso-puberulus; *tubus* subturbinato-hemisphæricus; *limbus* cupulatus fere ad medium usque in lobos 5 lato-triangulares carinatos, apicibus sinibusque acutis, fissus, pubescens raro subglabratus, persistens.

Corolla calycem fere 5-ies excedens, extus dense puberula, ante anthesin clavata postea hypocraterimorpha; *tubus* elongato-truncato-obconicus, intus glaber; *limbus* e lobis 5 patulis valvatis elongato-ovato-lanceolatis, margine apiceque villis densis albis (siccande flavidis) barbatis.

Stamina, corollæ tubum paululum superantia; *filamenta* glabra compressa à basi fere ad medium usque cum corollâ concreta; *antheræ* elongatæ lineares.

Stylus teres; *stigma* submersum e lobis duobus ovato-lanceolatis crassis faciebus unisulcis erecto-patulis constans.

Capsula stricta curvulave tenui-ovoideo-fusiformis à basi dehiscens, valvulis dorso cœstis 5 parum elevatis percursis.

Semina anguste subovali-lanceolata sæpius asymmetrica, alâ margine lacero-fimbriatâ ciliatâ, basi angustata et ibidem integra bilobave.

The above description was drawn up from fresh specimens, and I have omitted only a few microscopic details which are common to the genus and the tribe.

The normal form of the leaf is undoubtedly oval, tapering decidedly at the base, less (or not at all) at the apex. In the vast majority of plants, the form of the leaf is modified in proximity to the inflorescence, and where the leaves pass insensibly into floral bracts, the modification is often considerable; so that (in collecting plants) where no leaves of the normal form existed on a flowering ramulus, or so nearly adjacent to it that they might be comprised in the specimen without making the latter of inordinate size, I have, whenever practicable, dried leaves of a sterile branch separately; and, indeed, that ought perhaps always to be done, for the presence or absence of stipules, and their exact form when present, can often be ascertained only by inspecting the growing apex of a barren branch. But, as Klotsch has described the leaves of this *Cinchona* as "ovato-ovalia," I took some trouble to ascertain if this were really the prevailing form, and I measured, on leaves taken from several trees, the distance of their conjugate axis (or line of greatest breadth) from the base and apex. This line was, in nearly all cases, farther from the base than from the apex, so that had not the attenuation of the base always exceeded that of the apex, the leaves ought to have been obovate. With my pencil I completed the oval, so as to cut off the tapering base and apex, and on measurement I generally found it an almost exact ellipse. I add the dimensions of a few of the leaves I measured, including both normal and extreme forms; where it is to be observed that, in the first factor, the first member represents the distance of the widest part of the leaf from the base, and the second from the apex, so that the sum of the two members gives the entire length of the blade of the leaf. The dimensions are in English inches and decimal parts.

Leaves taken from terminal ramuli of a luxuriant tree of 30 feet, from which I gathered some good seeds:—

No. 1, (4·8+4·65) × 6·7 inches.

No. 2, (5·1+4) 6·5 inches.

Leaf of a shoot 8 feet high, from an old stool:—

No. 3, (4·3+3·6) × 5·15 inches.

Leaf of a very vigorous branched shoot, 12 feet high:—

No. 4, (5·7+6·5) × 9·85 inches.

Fallen leaf from a tree of 25 feet:—

No. 5, (4·7+5·3) × 7·65 inches.

Leaf of a slender shoot from near the base of a large tree:—

No. 6, (2·3+1·7) × 2·4 inches.

Abstraction being made of the tapering bases and apices, the form of the leaves Nos. 1 and 3 is exactly oval, of No. 2 obovato-oval, of No. 5 ovato-oval, of No. 4 rotundato-ovate, and of No. 6 obovato-lanceolate. The petiole in all these leaves, except the last, was from 2 to 2·2 inches long; and the accompanying stipules measured $1\frac{1}{2} \times \frac{1}{5}$ inches. From four to six pairs of leaves, and three or four pairs of stipules, usually coexist on each ramulus.

As to the texture of the leaves, were they not so fragile, they are in nearly all cases thick enough to be called coriaceous. Fallen leaves are softer and tougher, and on picking up a blood-red leaf I have been struck by its similarity in look and feel to a piece of morocco leather. It is singular that even in dried specimens the leaves do not break so readily as when fresh. It is rarely possible to predicate accurately the texture of leaves from dried specimens. Fleshy leaves of *Peperomia*, *Begonia*, various *Gesneraceæ*, &c., become quite membranaceous, or even transparent, by drying. Coriaceous leaves, of a naturally dry constitution, such as of laurels, change very little in drying; but young juicy leaves of any plant are apt to dry very thin.

The degree of pubescence varies considerably; but never are the leaves entirely naked, and rarely are they so pubescent beneath as to be called tomentellous. The nature of the pubescence is pretty constant to one type—short, soft, and never appressed hairs.

The panicles, usually not more than nine inches long, sometimes reach 12 or even 18 inches. The type of the inflorescence seems to be, as in most *Cinchonæ*, the triflorous cymule, a terminal sessile flower and two lateral ones on short stalks; but as one of the latter is often obsolete (its place, however, being indicated by the presence of three bracteoles, one pedicellar and two calycine), and as there is sometimes an extensive dislocation of the normally opposite ramification of the peduncles, the ultimate disposition of the flowers occasionally puts on the appearance of a contracted raceme.

The length of the calyx is ·15 inch, of the corolla ·7 inch (tube ·5, limb ·2), and of the capsule 1—1·4 inch.

Cinchona Magnifolia, growing along with *C. Succirubra*, is easily distinguished from it by the form and the immense size of the adult leaves, and by the dull red-brown colour of the aged ones. The largest leaf measured was $26\frac{1}{2} \times 22$ inches, and the thick fleshy petiole seven inches more. The leaves are nearly always more rotund than those of *C. Succirubra*, cordate at the base, the apex cuspidato-acuminate; yet leaves adjacent to the panicles taper at the base as in the leaves of *C. Succirubra*, and those of young plants and suckers are ovali, or obovato-lanceolate, and attenuated at the base and apex. The veins make a very wide angle with the costa, towards the cordate base depressed below the horizontal line, and therefore greater than 90°, and they begin to curve gently upwards from their very insertion. The pubescence is longer and harsher than in *C. Succirubra*. The capsules, compared with those of other *Cinchonæ*, are as enormous as the leaves. I gathered one that was eight inches long, and the seeds are proportionally elongate.

I proceed now to state the result of a comparison of the specimens of *Cinchonæ*, collected in 1859 in the valley of Alausi, with those of *C. Succirubra* from Chimborazo. The *Cascarilla roja* seen at Puma-cocha in that valley was merely a slender drawn out shoot, and the dried specimens from it are extremely membranaceous. The following is my note on the leaves: *Folia*, elongato-ovalia v. obovato-lanceolata basi longe-attenuata, pilis paucis adspersa, recentia crassiuscula succosa siccando membranacea. I have seen quite similar leaves on drawn-out shoots at Limon; and from the milky juice of the Puma-cocha plant, I have no doubt it is the same species; but no one could safely assert this from the dried specimens alone, without having seen the living plants.

The specimens gathered in the same valley under the name of *Cascarilla cuchicara* consist of two forms, the one with nearly glabrous, the other with densely pubescent leaves. The latter alone possesses flowers and good fruit, and, until I saw how *C. Succirubra* varied in respect of pubescence, I inclined to consider it distinct from the former. It was gathered in the forest of Yalancay, below the heights of San Nicolas, on the northern side of the river Chanchan, and under

under rather adverse circumstances, for I came on the tree at nightfall, and when I had still some distance of very broken ground to travel to reach my resting-place. Whilst one of my men climbed the tree, and hastily broke off a few branches, the other cut off pieces of bark from its trunk, which were those sent to Kew under the name "*Cuchicara*." In the dusk I could not distinguish what we had got, but on opening my vasculum the following morning, I found some good capsules, a few fragmentary flowery panicles, and besides the rather imperfect leaves attached to the latter, only young leaves at the apex of two sterile ramuli. From those materials the following brief description has been drawn up, chiefly with reference to the differences from *C. Succirubra*.

Ramuli petiolique cinereo-tomentosi. *Folia* (juniora) 4·6×2·8 unc. *oblonga utrinque acuta* vix attenuata, secus paniculas late ovata, supra nitida et præter ad costæ dimidium inferiorem glabrata, subtus cinereo-tomentella; *venis primariis* 9—10-jugis angulo 41°—42° *adscendentibus* fere ad $\frac{3}{4}$ usque suæ longitudinis rectis de in incurvis et secus marginem anastomosantibus. *Paniculæ subcorymbosæ* *Calyx* eo *C. Succirubra* duplo major; tubus turgidior; limbus sanguineus glabratus rugulosus, lobis subacuminatis, *sinubus excavatis*. *Corollæ* saturate lateritiæ tubus paullo crassior *stamina* sat longe *superans*; limbi lobis sub brevioribus apice margineque supra medium parce barbatis. *Capsula* uncialis oblongo-ovoideo-fusiformis eâ *C. Succirubra* crassior. *Semina* latiora robustiora, subovalia parum lacera a basi ad medium usque ciliata.

The other *Cuchicara* was obtained at Llalla, on the southern side of the Chanchan, about the wooded roots of the *paramo* of Azuay. It was out of flower, and the capsules had nearly all shed their seeds; but after a long search I found a few capsules which had still some seeds left. They were mostly much abbreviated—nearly globose—but on the same panicle were two longer capsules of quite the same form as those from Yalanca. The following are my notes on this *Cinchona*.

Ramuli, petioli foliaque nitida, præter fasciculos pilorum ad venarum (raro etiam ad venularum), *axillas* glabrata. *Folia* 7·5×4·5 unc. *oblonga* v. subovalia brevissime acuminata, basi sensim sub attenuatâ; *venis primariis* 10-jugis angulo 42°—43° *adscendentibus*. *Stipulæ* iis *C. Succirubra* subconformes.

It will be remarked that in both these forms the leaves have the same general outline, the margins nearly parallel towards the middle (therefore rather oblong than oval), proportion of length to breadth as five to three, and that the veins are inserted at the same angle. But I find no fascicles of hairs in the axils of the veins in the pubescent, as there are in those of the smooth variety, and this is really the only difference of importance. They can hardly be varieties of *C. Ovata*, for in Fitch's beautiful figure of that species the leaves, even of a barren shoot, are represented somewhat ovate, by no means oblong, and the angle of the veins is greater than 50°. Were I to be guided by the description in De Candolle's *Prodromus*, I should consider the *Cuchicara* only a variety (and a very slight one) of *C. Condaminea*, H. B. K.

The specimens gathered at Llalla under the name "Pata de Gallinazo," are liable to the same animadversion as those of the "*Roja*" from Puma-cocha; for they were taken from a young plant eight feet high, growing in deep shade, to which circumstance may safely be attributed the want of redness on the veins, noted in my "Visit to the *Cinchona* Forests." I have now sedulously compared the specimens with those of the *cuchicara*, and can find no tangible difference. The leaves have the same general outline, the venation, and the tuft of hairs in the vein axils. They are more decidedly acuminate, and very acute; but the same peculiarity is to be seen in the leaves of young plants of *C. C. succirubra* and *magnifolia*.

I have, &c.

Chonana, near Guayaquil,
22 September 1861.

(signed) Richard Spruce.

NOTE respecting the Map.

The accompanying Map is intended to illustrate both the present Report on the expedition to procure seeds and plants of *C. Succirubra* by Mr. Spruce, and his former visit to another part of the "red bark" region in 1859, an account of which was printed in the Journal of the Proceedings of the Linnean Society.

This region, comprising the forests on the western slopes of Chimborazo and Asuay, and the courses of the rivers which fall into the Bay of Guayaquil, has never been correctly laid down in any map. Many of the rivers mentioned by Mr. Spruce are not to be found in the best atlas, and the courses of many of those which are marked are quite incorrect. Very few of the names of places, too, in Mr. Spruce's Report are to be found in any existing map, and those which are marked are frequently in wrong positions. All the positions depend on that of Guayaquil, while scarcely a single authority agrees as to the longitude of that town.

Villavicencio gives the longitude of Guayaquil in	80° 9' 51" W.
Inman - - - - -	79 56 0 W.
Raper - - - - -	79 52 7 W.
Admiralty chart - - - - -	79 51 0 W.
Arrowsmith and others - - - - -	79 50 0 W.
Keith Johnston - - - - -	79 43 0 W.
English Cyclopædia of Geography - - - - -	79 23 0 W.

By far the fullest map of this region is that which was published by Villavicencio, in 1858, to accompany his work on the geography of Ecuador; and I have, therefore, been obliged to take Villavicencio's map as a guide for the courses of the larger rivers, and the positions of the principal places, for want of a better.

But Mr. Spruce, in a note at page 66, states that Villavicencio is not to be depended upon, and mentions several errors in his map. In the accompanying map I have corrected these errors, in accordance with Mr. Spruce's statement, and I have marked the places and courses of rivers which are mentioned in Mr. Spruce's Report, but which are not to be found in any map, as nearly as possible according to his descriptions. Of course, with data so insufficient, accuracy is not attainable, but at the same time the present map is fuller and more accurate than any that has before appeared, comprising the "Red Bark" region of Ecuador, and all the places and rivers mentioned in Mr. Spruce's Reports will be found in the positions assigned to them by him, or as nearly so as was possible, while retaining Villavicencio's positions for Guayaquil and the other chief towns. Both the longitudes of Villavicencio, and those of the Admiralty Chart, are indicated on the map.

Lucmas and Limon, though they are merely small farms, are marked in capitals, because the former was Mr. Spruce's head quarters during his visit to the Cinchona forests in 1859, and the latter during his operations in 1860.

(signed) Clements R. Markham.

India Office,
3 January 1862.

This is a detailed historical map of the northern region of Peru, showing the Amazon basin and surrounding areas. The map includes major rivers like the Amazon, Ucayali, and Marañón, and cities such as Lima, Cuzco, and Arequipa. It also depicts the Andes mountains and the Pacific Ocean.

— No. 45. —

COPIES of CORRESPONDENCE relating to the Employment of Mr. *Pritchett*.

MEMORANDUM.

ON 19th December 1859, Mr. Pritchett addressed the Under Secretary of State for India, stating that he had been in communication with Mr. Markham, and that he had offered to procure cinchona plants from the Peruvian province of Huanuco. He was informed, in reply, that Mr. Markham had authority to pay 500*l.* to any one whom he might think proper to employ in the Huanuco forests.

In a letter dated 16th December, in reply to one from Mr. Pritchett, Mr. Markham had stated that he would employ him if he came out to Peru at his own expense, before Mr. Markham left for the interior.

Mr. Pritchett did not arrive while Mr. Markham was in Lima, but, when Mr. Markham started for the interior, he left Mrs. Markham in full possession of his views and intentions, in case Mr. Pritchett should arrive during his absence.

— No. 46. —

Mr. *Pritchett* to Mr. *Markham*.

My dear Sir,

Lima, 10 April 1860.

I ARRIVED here yesterday from Southampton. Having applied to Messrs. Gibbs & Co. for your instructions, I was extremely sorry to find that the answer received was that none had been left by you, and that they recommended me to communicate with you by letter.

Knowing how precarious is the chance of any letter now finding you, and even should I receive your answer to this within two months of the present time, how large a part of the season will have gone away, I earnestly beg of you to answer this as early as possible, sending me instructions, and authorising Messrs. Gibbs to advance me enough to pay the expense of mule hire in the interior.

I have, &c.
(signed) *G. J. Pritchett*.

— No. 47. —

Mrs. *Markham* to Mr. *Pritchett*.

Arequipa, April 1860.

MRS. MARKHAM is sorry to inform Mr. Pritchett that Mr. Markham has already left this for the interior, therefore the best thing for Mr. Pritchett to do will be to proceed immediately to the forests of Huanuco, and if possible to bring down plants and seeds to unite with Mr. Markham's collection.

Mrs. Markham is not aware whether Mr. Pritchett has already received any instructions, and, therefore, it may be best to repeat what Mr. Markham wishes Mr. Pritchett to do, which is to collect young plants, and if possible seeds, of the three following species of cinchonæ, namely, *C. nitida*, *C. micrantha*, and *C. glandulifera*.

C. nitida may be distinguished by its bark being of a clear grey colour, from the silvery lichens which almost entirely cover it. The parts not covered by lichens are of a chesnut colour. Its leaves are lanceolate-obovate, capsule narrow, twice as long as broad, corolla roseate, and very fragrant. It is known in commerce as "grey bark," and also as "*Quina Cana Legitima*," and is especially found at Panatahuas, Casapi, Cuchero, and near Huanuco.

C. micrantha may be known by the white colour of its bark, and greater roughness of surface; when cracked it is more fibrous, and of a light cinnamon

brown colour. The leaves are broadly ovate, rather downy underneath at the base of the veins. Panicle very large, brachiate, many flowered. Corolla white, and densely silky. Capsule three times as long as broad. Contrary to the usual habit of cinchonæ, this species is met with in the bottoms of valleys, and on the banks of rivers. It is known as "*Cascarilla de Chicoplaya, de flor frecuente*," and is distinguished from other species round Huanuco by the pleasing white colour of its flowers. "*Pata de Gallinazo*" is the bark of the younger and upper branches of this species, so called from the black scrawly lichen (graphis) which grows on the exterior. It is found in the cool and shady tracts of Chicoplaza, Mownon, and Cuchero, growing in low damp situations.

C. glandulifera.—This is the most valuable species of the three. Its bark is known by its dark colour, only here and there varied by small greyish green spots, and the inside should be the colour of a ripe orange, shading into fiery brown. Leaves ovate, lanceolate, on the upper side smooth and shining, on the under side hairy. Corolla pale rose colour, velvety on the tube, and woolly inside the limb. Capsule three times as long as broad. Known in commerce as "*Cascarilla Negrilla*." It is found in Panatahuas, Chicoplaza, Mownon, and Cuchero, but is rare, only being met with on the higher mountain ridges. It flowers in February and March. Mr. Howard has also mentioned to Mr. Markham that a valuable species known as "*Cascarilla de Hoja de Oliva*" is found on the Cuesta del Carpis and near San Rafael, and that the *C. Uritusinga* of Loxa has been found in Chicoplaza.

Arrangements will be made with Messrs. Gibbs for advancing the necessary money (500 dollars) to Mr. Pritchett, who had better leave directions for having his letters forwarded, in case Mr. Markham should have any further instructions for him. If Mr. Pritchett leaves Lima as soon as possible he will be at Huanuco in the beginning of June, and may have the plants down to the coast in time to meet Mr. Markham.

— No. 48. —

Mr. Pritchett to Mr. Markham.

My dear Sir,

Lima, 17 May 1860

I BEG to acknowledge receipt of 500 dollars received from Mrs. Markham by last steamer, also a letter containing instructions, in accordance with which I shall leave to-morrow morning for Huanuco, and hope to be successful in bringing down seeds of the different cinchonas mentioned. I shall leave my address with Messrs. Gibbs.

I have, &c.
(signed) G. J. Pritchett.

— No. 49. —

Mr. Markham to Mr. Pritchett.

Sir,

Lima, 15 June 1860.

I ARRIVED at the port of Islay on the 1st instant with my collection of Cinchona plants, and shall convey them to India by the steamer which leaves Islay on June 24th. On reaching Arequipa I received your letters, dated from Lima on April 10th and May 7th, and a copy of Mrs. Markham's instructions to you.

I conclude that you are now about to enter the Cinchona forests of Huanuco or Huamalies, and that you will be fully engaged in the work of collecting before you can receive this letter, in which I propose to transmit my final instructions before leaving the coast. You will see that I have succeeded in completing my collection of plants much earlier than I had expected.

Mrs. Markham has already supplied you with information respecting the three species of Cinchona to which you should turn your attention; and you will observe that the principal localities to be examined are in the vicinity of Huanuco; or else, like Chicoplaya, in the ravine of the river Monzon, in Huamalies, which I think ought also to be explored.

The

The plants should, if possible, be young seedlings; but you will very likely find great numbers of root shoots, springing from trunks of trees which have been cut down, with good roots of their own. These also should be collected, and, if too tall, cut down to a length of about 18 inches, and relieved of leaves and top hamper.

For transport across the cordillera, the plants should be packed in layers of damp moss, and sewn up in packages of warm matting, or banana leaves.

Your attention should be particularly directed to the collection of seeds. You should ascertain the time they are ripe, and take them just before the capsule opens, and the seeds are scattered. This operation will require considerable care. Mr. Spruce proposes to spread sheets under the trees at the time of cutting or breaking off the branches bearing capsules. When collected, the seeds should be dried, carefully kept dry, and occasionally aired. On arriving at Lima, they should be delivered to Mr. Petrie at Callao, the agent of the Pacific Steam Navigation Company, with a request that he will forward them to England.

As soon as the plants arrive in Lima, you will establish them in Wardian cases, which I have ordered to be made here for that purpose, and forward them to Southampton; but I will write to you more fully on this subject in a few days.

Much must, of course, be left to your own discretion in this important enterprise, and the information you obtain on the spot will be a much better guide to you than any instructions that I can transmit with regard to the localities to be examined; but I would particularly recommend the forests along the course of the Mowyon, and those near Chinchao, and the Cuesta del Carpis.

You should take notes of the soil, climate, and position in which the Cinchonæ grow, and forward a report of your proceedings to the India Office immediately on your arrival at Lima. Dried specimens of leaves, flowers, and capsules should also be procured, if possible, and transmitted. Wishing you health, and success in this undertaking,

I have, &c.

(signed) *Clements R. Markham.*

— No. 50. —

Mr. Markham to Mr. Pritchett.

Sir,

Lima, 29 June 1860.

You will receive this note at the same time with another dated the 15th instant. With regard to your collection of plants and seeds of the Cinchonæ, I have ordered cases to be made here for the reception of the plants on their arrival, by a carpenter named Lewis, whose workshop you can find out from the clergyman here, the Rev. J. Henry. You can establish the plants in the carpenter's yard, and have them removed to Callao on the day the steamer sails, and you will find no difficulty in procuring fresh soil. There will be six cases.

The cases should be filled with soil to a depth of eight or nine inches, and the plants should be planted in rows from the back to the front of the case. This should be done as soon as possible, as every day that they are out of the soil lessens the chance of their growing. The distance from plant to plant must be regulated by their size, but in the case of their having much foliage, it is better that they should be rather wide apart, as the crowding of the leaves is always injurious, often inducing mildew and mould. After being planted, the plants should be well watered; and if the cases are not to be immediately moved, they should be sprinkled from time to time as they get dry.

On the surface of the soil, between each row of plants, a flat piece of wood should be placed, three or four inches wide, extending from the back to the front of the case, held firmly down by two other pieces extending the whole length of the case—the one being nailed to its back and the other to its front. The one along the back should be put in before the plants. The under edge of this batten ought to be just far enough above the surface of the soil to allow the ends of the cross battens to be inserted under it. By this means the soil and plants are kept from being disturbed in the operation of moving the cases.

When the cases are to be finally closed, the soil should be in a medium state, as regards moisture, and all the dead foliage should be removed. They should be made as air-tight as possible by means of putty and paint.

The seeds should be made up in paper parcels, about half an ounce in each, which should all be put in a canvas bag, and kept hanging during the voyage in some airy part of the ship, such as the captain's cabin. The paper should be of an absorbent nature, so as to dry up any moisture coming from the seeds, such as common brown paper.

In addition to the main packet of seeds, you are to make up two smaller ones, to the address of the Governors of Jamaica and Trinidad, to the care of Her Majesty's Consul at Panama, and the large packet is to be sent to the address of the Under Secretary of State for India.

You should make arrangements with Mr. Petrie at Callao about the shipment of the Wardian cases in the first steamer for Panama, on the upper deck, and you will pay Lewis, the carpenter, for them; but I will request that the sum may be repaid to you, and not included in the 500*l.*, so you should send in an account of it.

Wishing you every success,

I have, &c., in great haste,
(signed) *Clements R. Markham.*

Note.—In the event of Mr. Pritchett meeting with any opposition from the local authorities in embarking his plants, I have supplied Mr. Jerningham, Her Majesty's Consul-General at Lima, with a copy of the letter from the Minister of Finance to the Superintendent of the Custom-house at Islay, ordering him to allow my plants to be embarked, which will be an unanswerable argument.

Clements R. Markham.

— No. 51. —

From *G. J. Pritchett, Esq.*, to *Clements R. Markham, Esq.*, India Office,
London.

Sir,

Lima, 13 September 1860.

On the 16th ultimo, the day on which I arrived in Huánuco from the bark districts of Cocheros, Casapi, Pampayaco, and others, where I had been engaged the previous two months in examining the most favourable spots for carrying out my object of obtaining seeds and plants, I had the pleasure of receiving your two favours of 15th and 29th June, from Lima, containing for my guidance some further particulars, in addition to those already received, of the distinguishing characteristics of the different species of barks to be observed, and also instructions as to the packing and delivery of the seeds and plants.

Although the arrival of these letters to my hands has been so tardy, I may, nevertheless, venture to hope that no prejudice has been thereby caused to the execution of my mission, as every particular, with the exception of only one unavoidable item, has been complied with. The collection, for instance, of seeds, to which you desire that special attention should be paid, in preference to that of young plants, I had already determined on before leaving London, where I learnt from Mr. Veitch, that he thought success more likely to be achieved through the ripe and carefully gathered seeds than by means of the plants. If it had been otherwise, and the plants had been considered more desirable than the seeds, it would have proved very costly for me, as the carriage from the bark woods to the coast ranges from 25 dollars to 30 dollars per cargo of 12 arrobas.

I was therefore the more glad to find that the instructions received by me in Huánuco, on my return from the Montaña, had been already and fortunately anticipated, as I have obtained a good quantity of ripe seed, well dried, and most carefully packed, and which will be delivered in perfect order, according to your letter. I could greatly have increased the quantity, had I not been obliged to return to Lima by the end of August. I have also been very much hindered from getting seed earlier, by the season having been unusually wet and unfavourable for its ripening, so that it was only within the last fortnight of my being in the forest that the greater part of the seed was gathered, it only then having become sufficiently ripe for the purpose.

Should it be necessary, it would not be difficult to make arrangements for an annual supply from the Huánuco district of considerable quantities, both of seeds and plants.

My

My departure from Huánuco for Lima was on the 21st ultimo, and I am sorry to say that my arrival at the latter place was not in sufficient time to embark the plants in the steamer of the 29th. My first care on arrival there was to get the plants established in the Wardian cases, which was done in the course of a few days, as soon as the carpenter had finished his work, and admitted of so doing. The expenses and cost of the Wardian cases, including shipping, railway, &c., are 186 dollars.

By the present steamer, the following are shipped to the care of C. T. Bidwell, esq., Panama; viz.—

Six Wardian cases, plants, containing 10 in each, addressed to the Under Secretary of State for India.

One bale, containing one packet, addressed, Under Secretary of State for India, containing 24 doz. $\frac{1}{2}$ oz. papers, *C. micrantha* seed, var. *Provinciana*.

18 doz. $\frac{1}{2}$ oz. papers, *C. nitida* seed.

8 doz. $\frac{1}{2}$ oz. papers, *C. micrantha*, var. *Patá & Gallinazo*.

One packet, addressed, H. E. the Governor of Jamaica, containing,—

6 doz. $\frac{1}{2}$ oz. papers, *C. micrantha* seed, var. *Provinciana*.

4 doz. $\frac{1}{2}$ oz. papers, *C. nitida*.

One packet, addressed, H. E. the Governor of Trinidad, containing,—

4 doz. $\frac{1}{2}$ oz. papers, *C. micrantha*, var. *Provinciana*.

4 doz. $\frac{1}{2}$ oz. papers, *C. nitida*.

all of which I trust will arrive in perfectly good order at their respective destinations.

I shall embark in the present steamer, and hope to have the pleasure of seeing you about the middle of next month. My address will be as before, the Fishery, Boxmoor, Herts.

I am, &c.

(signed) G. J. Pritchett.

—No. 52.—

LETTER from G. J. Pritchett, Esq., to the Under Secretary of State for India.

Sir,

Boxmoor, Herts, 9 July 1861.

THE particulars of the circumstances causing the delay of my report on the bark districts of Huanuco, which I visited last year for the purpose of collecting certain species of the plants and seeds of *Cinchona* peculiar to it, are already before you.

I have now the honour to submit, for your information, the following details:—

Having obtained letters of introduction in Lima, and made what preparations were needful in that city, in the way of waterproof tent for the forest, as well as warm clothing for passing the cordillera of the Andes, I took my departure from that city on the 18th May, leaving there a letter to be forwarded to Mr. Markham, intimating my having done so.

The city of Huanuco was reached on the 28th, a distance of eighty leagues. It is situated on the eastern slope of the Andes.

This being the last point for procuring mules, as well as preparing provisions, it was necessary to remain here some days to carry out these objects. In the meanwhile, I was engaged in procuring as much local information as possible, in connexion with my object.

A very short time proved how interested the community of Huanuco are in the products of the neighbouring forests. I was welcomed by the governor of the place, and everything that would in any way contribute to success was placed at my disposal. Through the kindness of several of the residents, I was enabled to obtain the services of a Bolivian, who had in former years been engaged in getting out bark, to a considerable extent, and was well acquainted with the several most interesting spots in the forest for that purpose.

The time of my arrival in Huanuco was unusually favourable for gaining information on every point that might be necessary, and ready and eager replies were given to my inquiries, in consequence of the expectations of the inhabitants being at the highest respecting the future prosperity of their city, on account of

a grand road, which was already commenced, for connecting the province of Huanuco with the river Ucayali (about fifty leagues to the east), the largest and most important of the southern tributaries of the Amazon.

Arriving at this time, with introductions from members of the Government in Lima, and not having anything to do with the usual objects that take people to Huanuco, it was impossible that the popular mind could allow me to pass unnoticed. To me, therefore, was assigned the post of emissary from the Government for ascertaining the most suitable point on the Ucayali which should be made the terminus of the road, with the view of connexion with the Amazon by large steamers on the former river.

Provisions of dried meat, biscuit, lard, rice, tea and coffee, sugar, spirits, tin teapot and mug (the spirits being the most important of all in the damp forest) being ready, I left the city of Huanuco for the forest on the 9th June, having been delayed there twelve days by these indispensable preliminaries.

The route to the bark district (I should say to the centre of the district, as it extends from north to south over a distance of at least from forty to forty-five leagues) lies to the eastward, the first part of the road, for about five leagues, being down the valley of Huanuco, and more or less along the river's bank. Sugar-cane estates occupy the land on either side, whose products supply the mineral district of the Cerro de Pasco with large quantities of the aguardiente, the rum of the country, and is a source of extensive support and profit to the inhabitants. The whole of the cultivation is by irrigating canals from the river, a system most thoroughly understood by all the Indian population of South America.

Leaving the valley of Huanuco, the road strikes off to the left, in a northerly direction, gradually ascending from the river, in the direction of the highest part of the chain of mountains, at the top of which is Carpis, and at a distance of about two leagues is the village of Acomayo. This is the halting-place generally adopted by travellers leaving Huanuco, on account of eggs and alfalfa being both obtainable here, and the necessity for giving a good rest to the mules before attempting the pass of the mountain. It was my fate to both ascend and descend this mountain on foot, on account of the unusually unfavourable state of the road at the time of my entering the forest.

The great mountain range of Carpis may be considered the outpost of this part of the forest. On one side, from its towering elevation, you look over the boundless sea of forest vegetation to the eastward; on the other, in the direction of the cordillera and Huanuco, the prospect consists of every form of bare rock and arid mountain, except in those few instances where the bed of a valley is visible, and the green patches of irrigation can be distinguished.

On the forest side, the vapour and cloud which rise are continually bathing the woods, which seem at this spot to be the perpetual focus for the converging clouds. They are carried over the tops of the range towards the more heated plains of Acomayo, and bear with them in that direction, for a short distance, their beneficial and nutritive influence, though it does not extend above a league or a league and a half.

The atmospheric changes which rapidly take place at this point are very great, every vicissitude of temperature being experienced here within a few hours—at one time, a raging tempest of rain and wind; at another, the calm, tranquil, leaden atmosphere of chilling cloud and fog. I presume the almost fathomless depths of the water-worn abysses of the forest, the great proximity of their sides to each other, at the same time that they are under the influence of a tropical sun, will account for these phenomena.

Carpis contains many specimens of trees of the *Cinchona* species; among them the *C. purpurea* immediately arrests attention, on account of the distinctive character of its foliage; it is very abundant here, as well as in other parts of the forest which I visited. I presume it made more impression on me here, as I saw it for the first time.

C. nitida is common on the north-east side, and at the upper part of the mountain.

C. obovata, the source of the olive-leaved, but known there as the *lucumo*-leaved species, is met with in small quantities, but with characteristics so decided that I could have no doubt of its being the species so called. It required several days' examination before it could be discovered, and I had almost despaired of finding it, when the last day brought success.

C. micrantha,

C. micrantha, var. *Provinciana* and var. *Pata de Gallinazo*, are both inhabitants of the lower levels of the mountain. Other species were met with, which may be valuable; but as my object was confined to those above named, and my time was exceedingly limited, it was urgent for me to make the most of the short remaining season, and dedicate the whole of my energies to carrying it out in the most effective manner possible.

I lost the opportunity of seeing an important distinctive character of the *Cinchonas* by arriving on the ground too late to see the trees in flower, so I was obliged to be guided by other peculiarities, in which I trust I have been successful.

The nature of the ground, the dense and lavish character of the vegetation, which is exuberant beyond expression, have hitherto effectually kept this region in a perfect state of seclusion and almost entirely unknown, except to the few natives who, in naked loneliness, have been urged by hunger to thread their way through the brakes and sloughs of its rank wastes, when escaping from the thrall of some oppressive estate owner, or pursuing the chase of some wild animal for food to support the exertion necessary for threading the difficult mazes of the entangled woods.

Chinchao is the first village met with in descending the valley of the river of Casapi, of which Carpis is the head. It gives its name to a cinchona district in the neighbourhood, on both sides of the valley, from which specimens of cinchona have been brought, and sometimes also applies to the chain of lofty hills or mountains on the left bank, which connects the crest of Carpis with the important bark mountain of Cayumba, within a league or so of the river Huallaga, to which the river of Huanuco is tributary.

On this chain of hills the same species of cinchona are met with: in the upper parts, the *nitida* and *obovata*, and in the lower, the *purpurea* and *micrantha*.

Chinchao is the only village of this valley, consisting of about 20 huts and a church.

The coca hacienda of Casapi was reached on the 13th June, having passed, on the way down the valley, the different coffee and coca haciendas for the cultivation of those products.

Casapi.—This hacienda is an extensively cleared portion of the forest for the cultivation of the coca shrub, whose leaves are greatly appreciated among the labourers of the country as a stimulant of a peculiarly supporting character—many nights and days of laborious watching and exertion being undergone by the assistance of its strange properties.

To the miner it is considered indispensable, and the important mineral district of Pasco, which contains many thousand inhabitants, would be a desert were it not for the strange energy imparted to the miner by the use of the leaf of this invaluable shrub.

It is masticated, with the addition of a small quantity of caustic lime, which is carefully introduced to the chewed mass at the end of a small stick. “Hualqui” is the name of the hide bag containing the coca leaves, and “poto” that of the small *maté* containing the lime.

Casapi is situated at the lower or eastern end of the valley, where it joins the main valley of the River Huallaga. This was the first scene of continuous exploration. It was here that I was joined by my guide, who did not join me for 10 days after my arrival.

In the meantime, I proceeded to make use of all the means at my disposal, by availing myself of the people of the hacienda to show me the tracks and intricacies of the neighbouring woods, all which was most kindly permitted by the owner of the establishment, who is the son of the gentleman who entertained Dr. Pöepig when he visited these parts. With this assistance, I was enabled to examine the whole of these woods before the arrival of Juan, my guide. The result of the exploration proved how active had been the operations of the collectors in the time of former bark speculations; for, with but rare exceptions, every tree had been felled, and nothing was left to subsequent collectors but to wait till the younger plants should come to their full maturity.

It was evident that this was not the spot for my purpose.

Casapillo is situated on the high land which is formed by the junction, at an acute angle, of the Casapi valley with that of the Huallaga. Its height above the woods of Casapi is between 400 and 500 feet.

The only species found here was the *C. nitida*, whose only habitat is airy situations; but, as in the case of Casapi, it had been visited by the collectors, and every cinchona tree had been felled; the spot was soon abandoned for search in others of better promise.

The extent of this wood, which is on a high spur of land which comes from the range of hills in the direction of Pillao, is several square leagues.

Cocheros.—The mountain called San Cristoval de Cocheros is situated at about three leagues from Casapi, close to the Huallaga. The owner of these haciendas told me that it had never been visited by collectors, and that I could prosecute my search in its woods as much as I pleased. It rises, an isolated mountain, from the low land at the conflux of the two rivers, to a height of about 1,200 feet above them. This point is about the centre of the bark district of Huanuco.

It has on the north, or lower down the Huallaga, within a 15-league radius, the following bark-producing stations: Chicoplaya, San Antonio, Tingomaria, Huachipa, Cayumba, Patayrondas, besides others on the Monzon River. On the south, in the direction of Panao, Pampayaco, Lanzabamba, Jaupe, Mallgo, Iguacará, and Pillao.

On the arrival of Juan (my bark guide), I immediately set to work to determine the capacity of our new scene of labour for producing cinchona seed, and daily were the trips made into its woods for that purpose. But it was soon clear that, however much was met with, and seemed merely to require a few days to ripen, nothing could be done for the present, as the capsules were only recently formed.

During this pause, which was unavoidable, it seemed desirable to have other woods, known to contain the *nitida* and *micrantha* species, examined at the same time, to ascertain the state of the seed there, which, if more forward, could have been harvested before the Cocheros seed was ready. None, however, was found to possess the advantages of this spot for my purposes. I therefore determined to make the entire collection of seeds and plants from this point, and commenced at once to fix on the trees in the most forward state, so as to watch the gradual maturing of the seeds, both of the *nitida* and *micrantha*. It seemed as if a few days would be sufficient for the purpose, yet several weeks elapsed before the first lot of seed was gathered.

The Governor of Tingomaria sent me several specimens of bark from his neighbourhood, and offered me access to the woods of his district; but the swollen state of the river, which had for a long time prevented any communication from below, and having the species I required so near at hand, made me thank him for his kindness without availing myself of it.

He sent several specimens, which proved to be of the *micrantha* and other species found in Cocheros.

From the reports brought me by people engaged by me in the search for the *nitidas* and *micranthas* as well as the *C. obovata* in the mountains of Pillao, I have no doubt that this district to the south of Cocheros, with the intermediate points enumerated above, would yield a prodigious quantity of these barks, should the time ever arrive of its attaining a commercial value.

Huachipa was reported to me, by an old Spaniard, and formerly a collector, as containing the *C. obovata*. We searched there for it, however, without success.

The first examination of Cocheros gave very little promise of good. I commenced at the east corner of the mountain, on the lower side next the river, and gradually rose along the south-east face, in a zigzag direction, till the summit was reached. Here an abundance of *C. nitida* trees was met with, having a fair quantity of seed, though in the early part of the ascent I was greatly disappointed at meeting with only few, but very fine, specimens of the *nitida* and *micrantha* species. I was somewhat reconciled, however, with the reflection that it was probable the sunny side of the mountain would prove more favourable to the cinchonas, more particularly those requiring warmth and moisture, and I looked forward to the morrow to try the correctness of the surmise. Early next day, our course (the starting point being the same as yesterday) was directed due north, parallel with the line of the river; and having ascended sufficiently high to be well in with the *micranthas*, which already showed greater development than on the south-east side, we continued in a horizontal direction along this face of the mountain, meeting with a most satisfactory show of the *var. Provinciana*. We

marked

marked the trees as we entered, by way of precaution, so as to arrive at the same spot on a subsequent visit, which had to be repeated a great many times before felling the trees for gathering the seed.

The *var. Pata de Gallinazo* is scarce on this mountain, as well as on every other we visited, compared with the *var. Provinciana*. They both grow to very large size, and the foliage is somewhat similar, but they are easily distinguished by the bark.

Some of this species I found to be as large as 30 inches diameter, and a noble and elegant appearance many of them have among their brethren of the forest, rising in some instances as high as 70 feet.

Our day's work confirmed me in the determination to take this point as a fair specimen of the district. The supply of trees and seeds being so ample, and the field of exploration being so comparatively near to the coca hacienda before named, made this spot suitable also for the drying process, so very needful for the delivery of the seed in good condition on the coast.

Being entirely satisfied as to the existence of the seeds at this point, I now only felt great anxiety about the weather. Although it was then about the middle of the dry season, heavy soaking rains were still falling from day to day, and the seed seemed to make no progress whatever towards maturity.

Towards the latter part of July the weather broke up, and the sun began to make impression on the solid banks of clouds that filled the valleys. Though clouds were the prevalent visitants during this so-called dry season, there were occasions, during some portions of the day, when the sun unveiled, and even penetrated to the very underwood of the forest.

But even to the last day of my remaining here, when we had nearly a fortnight's fine weather, with only an occasional shower, the tracks were still deep with mud, and only in the exposed situations could the mud be found less than ankle-deep. This fortnight of fine weather was the harvest that was necessary to be fully improved.

The rapid ripening of the seed kept as many hands as I could procure from the hacienda occupied in felling the trees, and stripping them of their seed. After various trials, I found that the felling of the tree was the best way of proceeding under my present circumstances. My time was very short, and the quantity of seed suddenly ripened so plentiful, that to attain my object of getting a good supply of it I could afford to be extravagant; and although much more seed was lost than what was gathered, still my limited time compelled me to adopt this plan.

During the fortnight we were engaged in this work, seven large trees were felled daily, and denuded of their capsules. At this same time the drying process had to be attended to in the hacienda, and every advantage to be taken of the sunshine, while the seeds were carefully protected from the breeze, which, with our utmost care, did not fail to deprive us of some of them. Our spoil having been so hardly earned, ensured this part of our operations being carried out with a jealous care, and the loss in this respect was reduced to a minimum.

By the 13th August, when it was necessary for me to leave, in order to arrive in Lima by the end of the month, the seeds were all carefully put up in outside wrappings of tar-cloth, and every precaution taken to protect them from external influence. The small plants had been brought in and packed in bundles, between layers of the cryptogamous parasites of the coca shrub, overlaid with coverings of palm-branches bound tightly together, and then enveloped in several thicknesses of the woollen fabric of the country, called "xerga."

If it had not been for the great expense of carriage to the coast, I should have brought more plants, as it would have been equally easy for me to have despatched from this district 100 cargass or loads of cinchona plants as the half load to which I was compelled to limit myself, and which I felt exceedingly unwilling to conform to.

During the journey down, I had the plants soaked morning and evening, except those few days on which we were passing the cold region of the Cordillera.

They were in perfect health when put into the Wardian cases in Lima, as also when they arrived at Southampton; I having, during the passage home, made it my business to attend to them, so as to preserve the temperature at as equable a state as possible.

With regard to the geology of the district in and around Cocheros, Casapi, Carpi, the Tingo, &c., the rocks are of the primary formation, and, in many

localities, highly disintegrated, large masses of hornblende, felspar, and micaeous minerals existing in great quantity.

The warmth of the climate (I allude to where the sun's rays are not intercepted by foliage), together with the almost constant moisture of the atmosphere (for it should be borne in mind that my visit was during the dry season), are no doubt highly conducive to disintegration, and hence the great fertility of the soil, derived, after the lapse of many centuries, from this particular class of rock.

Among all the distinct mineral species which abound on the surface of the earth, none are so rich in potash as felspar. This substance is very generally distributed in every direction, derived doubtless from the plutonic rocks by gradual disintegration. All the cinchona tribe are said to require a large quantity of potash for their full development, and hence the reason of their attaining such large proportions in this province.

The felspar which I brought to England, and which I have had examined by an eminent chemist, is pronounced by him to be, in conjunction with other mineral bodies, that best suited to form a rich and prolific soil, when heat and moisture have broken up its particles, rendering it thereby fit for assimilation by the plant.

There is also another mineral which is very abundant, viz. steatite, a silicate of magnesia and alumina. It derives its name from the soft and almost greasy texture it presents, resembling the solid portions of tallow or fat stearic acid. In the republics of South America the natives call it "jabocillo," or soapstone, for a similar reason. The vast quantities which abound in the Huanuco districts generally render them very interesting, both to the geologist and the mineralogist.

I cannot say, however, that I think the geology of the district, or, rather, the geological formation of the rocks (the primary source of the soils on which the cinchona plants grow), to be the sole cause of their flourishing here better than in other parts of the world, as in many other portions of South America, particularly in Chili, Bolivia, and Columbia, I have noticed the same description of minerals with comparatively little alteration. The whole chain of the Andes, from Cape Horn to the Isthmus of Darien, consists essentially of a species of granitic rock, termed "Andesite," differing somewhat from granite (properly so called) and from syenite, which was formerly supposed to constitute the great mass of that chain.

The region about Coquimbo, in Chili, is thickly strewn with disintegrated felspar. Mica, hornblende, and steatite also abound; but the climate of these countries, especially near the coast, precludes the possibility of the growth of the cinchona, it being very dry, with cold south-easterly winds. Nearer to Cape Horn, indeed, much rain falls, but that frigid latitude is also adverse to the growth of a plant so essentially tropical. Hence a climate is also necessary as well as a soil, even though the cinchona may find in the latter, to a certain extent, a fitting and congenial pabulum.

The climate of these districts is essentially moist and warm. The difference in degree, however, between that of the lower parts of the mountains, the habitat of the *micranthas*, and the higher, where the *nitidas* are chiefly found, is very striking, and too much stress can scarcely be laid on this characteristic. I was prevented making observations with my thermometer, as it was disabled on its way down the valley of Casapi. The difference I speak of, therefore, is that of the sensible heat. That I am not mistaken is proved by the perceptible change so remarkable in the character of the vegetation. For instance, within a vertical distance of 200 to 250 feet, it is scarcely possible for it to pass unnoticed. Another important condition, which favours the greater development of the vegetation of the lower levels, is the greater depth and infinitely richer quality of the soil. This is the natural result of the heavy rains, which carry with them the most rich and soluble parts of the upper grounds, and deposit them on the lower, accumulating there its stores of incalculable vegetable wealth.

It merely remains to me to express my wish that the results of my collection of seeds and plants in India, will confirm my present impression, that the service which I had the honour of being entrusted with was not inefficiently carried out.

I have, &c.

(signed) G. J. Pritchett.

— No. 53. —

From Sir *C. Wood*, Bart., Secretary of State for India, to His Excellency the Honourable the Governor in Council, Fort St. George; dated London, 17 August 1860.

Para. 1. I HAVE to inform you that Mr. Clements Markham, who was sent to South America last December, to procure a supply of the quinine-yielding cinchona plants, for introduction into India, has arrived in England, with a supply of both varieties of the *C. Calisaya*, and also a few plants of the *C. ovata* and *C. micrantha*.

2. Of these plants 216 are already throwing out shoots, and 53 more still retain life; being 60 per cent. of the number originally planted in the Wardian cases in the Peruvian port of Islay.

3. Mr. Markham will sail for Calicut, by way of Bombay, on the 27th inst., and it is important that the necessary preparations for the conveyance of the plants from the port of Calicut to the sites prepared for their reception in the Neilgherry Hills should be completed before his arrival.

4. The report forwarded by last mail, six additional copies of which are now transmitted, will have placed Dr. Cleghorn and Mr. McIvor in possession of all the details connected with Mr. Markham's expedition, and will have led them to anticipate his arrival by preparing the necessary sites for the cultivation of the plants.

5. Collections of cinchona plants and seeds of other valuable species from the north of Peru, and from Ecuador, will probably arrive in India towards the end of the present year.

6. I have to request that you will advance to Mr. Markham, during his stay on duty in your Presidency, such sums from time to time as you may be satisfied he requires for his own personal expenses, and for the efficient performance of the duty entrusted to his charge.

— No. 54. —

From *H. Cleghorn*, Esq., M.D., Conservator of Forests, to *J. D. Bourdillon*, Esq., Secretary to Government, Revenue Department, Fort St. George, dated 20 September 1860.

I BEG to enclose for the consideration of Government the accompanying letter of Mr. W. G. McIvor, Superintendent Ootacamund Garden, with an estimate of money required for preparing a site for the cinchona plants, expected almost immediately. The following suggestions upon Mr. McIvor's proposal occur to me:—

1. The 50 acres alluded to which lie convenient for superintendence should be reserved specially for the purpose.

2. Ten acres of forest might be prepared immediately, in anticipation of Mr. Markham's arrival. The cart track should also be made. Mr. McIvor has Mr. Markham's pamphlet and report, and knows what amount of shade should be left.

3. The timber felled should be lotted and sold by Mr. McIvor; the proceeds will be available for the preparation of the ten acres. In addition to this, I would suggest a grant of 2,000 rupees, to be accounted for as expended.

4. The simultaneous cultivation of peppermint, &c., is a good suggestion; but until Mr. Markham's arrival, I should not propose more than the preparation of ten acres. So far as I know, Mr. Markham has from 600 to 700 plants, all of course of small size; allowing for losses in transit, and the proportion to be sent to Mr. Thwaites, in Ceylon, this area will suffice; moreover, Mr. Markham may

consider other sites preferable, or may advise the trial of experiments in several localities for different species.

5. I have not heard of Mr. Markham's having reached England, but his arrival in India should be telegraphed at once to Mr. McIvor, from Calicut or Madras, according to circumstances.

— No. 55. —

From Mr. *W. G. McIvor*, Superintendent Government Gardens, to Dr. *Cleghorn*, Conservator of Forests; dated Ootacamund, 12 September 1860.

WITH reference to the order of Government, under date the 18th ultimo, No. 1220, I have the honour to enclose an estimate of the money required for the preparation of the cinchona site indicated in paragraph 9 of your letter dated the 31st July 1860, No. 83, and beg to solicit the favour of your making application to Government for the sanction of the amount required.

2. In the estimate I have included the cost of a bandy road from the cantonment of Ootacamund to the cinchona plantation, as this will enable us to cart manure at a small cost.

3. As the cinchona trees will be planted wide, and as several years will elapse before they cover the ground, I would suggest that peppermint be planted over the whole extent of the land, and the essence prepared for the medical department; this to be sold at what is considered its fair value. I make this proposition in order to economise the expense of this experimental planting, as I anticipate that the returns from the peppermint will in a great measure meet the expenses of keeping up the plantation.

4. In an experiment of this kind, where it is important to show that it can be profitably conducted, every exertion should be made in order to increase the returns from the undertaking; as a great drawback to the extension of the cultivation of the cinchona will be the length of time the plant requires to come to maturity.

5. I have just learned that Mr. Markham arrived in Southampton on the 28th of July, with a large supply of cinchona plants in good condition, and that they were to be dispatched to India by the first steamer in August; it is, therefore, probable that they may have already reached Madras; and as no preparation has been made for their reception, I will proceed at once with the work, in anticipation of the sanction of Government, and trust you will approve of this course, as I am most anxious for the success of the undertaking and the preservation of the plants, which would be endangered to a certain extent were they to arrive when entirely unprepared for their reception.

— No. 56. —

ORDER by the Madras Government, 28 September 1860.

1. Copy of the Despatch above recorded will be communicated to the Acting Conservator of Forests, the Collector of Malabar, and the Superintendent of the Government Gardens, Ootacamund.

2. Mr. McIvor will proceed at once to Calicut, there to await Mr. Markham's arrival. The Collector will afford all needful aid for facilitating the transit of the cases to their destination, and will also furnish Mr. Markham, on his arrival, with such funds as he may require to meet his personal expenses.

3. Copies of Mr. Markham's report to the Secretary of State will be forwarded to the Acting Conservator of Forests, Mr. McIvor, the Superintendent of the Láll Bāgh at Bangalore, and Mr. Holl (overseer) at Coonoor.

4. In

4. In his letter, dated 20th inst., the Conservator of Forests submits a letter from Mr. McIvor, detailing the steps which he proposes to take in pursuance of the Order of Government, dated 18th ultimo. The Government approve Dr. Cleghorn's recommendations; the 50 acres selected will, accordingly, be marked out and reserved specially for the cinchona plant. The other arrangements are as follows: 10 acres of the above to be immediately cleared and prepared, the cart track to be made, the felled timber to be sold, and the proceeds to go towards the expenses. A grant is also sanctioned of 2,000 rupees, to be accounted for when expended.

5. Pending the arrival of Mr. Markham, Mr. McIvor will confine the cultivation of peppermint to the 10 acres which are to be first cleared. The Government will be prepared to extend this permission, should Mr. Markham see fit to recommend it.

To the Collector of Tinnevely.

„ Resident of Travancore.

„ Collector of Sea Customs, Madras.

„ Commissary General.

„ Acting Conservator of Forests, with printed copy of Mr. Markham's report.

„ Collector of Malabar.

„ Superintendent Government Gardens, Ootacamund, with printed copy of Mr. Markham's report.

To Mr. New, Superintendent, Láll Bágh, Bangalore, with printed copy of Mr. Markham's report.

To Mr. Brown, Horticultural Gardens, Madras.

To Mr. E. Holl, Overseer, Coonoor, with printed copy of Mr. Markham's report.

To the Accountant General.

— No. 57. —

From Mr. *Clements R. Markham*, to the Secretary to Government, Madras;
dated Ootacamund, 22 October 1860.

I HAVE the honour to report, for the information of the Governor of Madras in Council, that I arrived at this place, with the cinchona plants which I had collected in the forests of South America, on the 12th instant.

2. I enclose a copy of my report* to the Under Secretary of State for India, in which will be found a detailed account of the present state of the plants, and my opinion respecting the site selected by Mr. McIvor for their cultivation.

*Mr. Markham to the Under Secretary of State for India, 20 October 1860.

3. With the sanction of the Secretary of State for India, I have employed agents in other parts of South America, distant from the region whence I have already procured a collection of plants of the *Cinchonæ Calisaya* and *ovata*, to collect plants and seeds of other valuable species. I expect that these additional cases of plants (15 or 20 in number) will arrive at Bombay towards the end of the year, whence a portion will be sent to Ceylon, and the remainder to Calicut, for transmission to the Neilgherries.

4. Pending the arrival of these additional plants, I propose, with the sanction of the Madras Government, and in pursuance of instructions which I have received from the India Office, to visit several of the mountainous regions of this Presidency, with the view of ascertaining whether any or all of them are suitable for the cultivation of the cinchona plant.

— No. 58. —

From Mr. *C. Markham* to the Under Secretary of State for India; dated Ootacamund, 20 October 1860.

I HAVE the honour to report, for the information of the Secretary of State for India in Council, that I arrived in these hills, with the cases containing cinchona plants, on the 12th instant.

2. Before leaving Bombay, I did not send any of the cases to Ceylon, because, after the treatment they had already received, I was unwilling to trust them on board the Peninsular and Oriental Company's steamers, without some one specially in charge of them; but I have arranged that seven of the cases out of Mr. Spruce's collection shall go to Ceylon, and exchanges can afterwards be made between the plantations in Ceylon and the Neilgherries.

3. On the 3d instant, I sailed from Bombay in Her Majesty's steamer "Pleiad," I. N., which had been placed at my disposal, by order of Sir George Clerk, for this service. The cases were landed at Calicut on the 7th, and sent up the river Beypoor on the same evening, in canoes. Much difficulty was experienced by the coolies in conveying such heavy loads up the Sispara Ghaut; but every facility was supplied by Mr. Grant, the Collector of Malabar; and Mr. MacGregor, one of the assistant collectors, rendered most efficient assistance, by superintending the conveyance of the cases to the summit of the ghaut, where they were taken charge of by Mr. McIvor, the superintendent of the Government gardens at Ootacamund. The cases arrived in the Government gardens, without any accident, on the 12th instant, and the plants were immediately examined by Mr. McIvor.

4. The plants had suffered very much from the delay of six days at Bombay, and during the voyage to Calicut many of them began to droop; but notwithstanding all they had gone through, a number were still throwing out green fresh-looking shoots when the cases were opened at Ootacamund. The roots, however, were found, on examination, to be all more or less attacked by decay, and it was at once apparent that the chief reliance must be on the cuttings which could be obtained from the shoots thrown out by the plants during the voyage. Mr. McIvor obtained 207 cuttings, more or less promising; and he also potted the plants, after carefully removing the decayed wood, in the hope that some might form new roots, and that others might continue to throw out shoots, whence additional cuttings might be obtained: 125 of these original plants were potted.

5. It is now more than a week since the collection arrived at Ootacamund, and already upwards of 50 of the cuttings have begun to grow; and 10 of the original plants have begun to sprout, whence more cuttings will be obtained. Thus the successful introduction of the *Cinchona Calisaya* and *ovata* into India is certain; and there is every reason to hope that, with the aid of Waltonian cases, which are now being constructed, I shall see as many cinchona plants before leaving India as I originally collected in the forests of Caravaya.

6. This success, as regards all that has led to it since the arrival of the plants in India, is entirely due to the skill and intelligence of Mr. McIvor, and to his great experience in the propagation of plants.

7. I have examined the site selected by Mr. McIvor for the first cinchona plantation, and consider it exceedingly well adapted for the purpose. The site is a sholah or wooded ravine, at the back of the range of hills which rises behind the Government gardens, and which entirely protects it from the west winds; whilst another high ridge completely screens it from the east. It is 7,450 feet above the level of the sea, and, from its sheltered position, is warmer by several degrees than Ootacamund. Like the thickets where the *Cinchona* grow on the pajonales of Caravaya, in Peru, it is surrounded by steep grassy slopes, with a vegetation analogous to that of the Caravayan pajonales. Thus the tree rhododendron takes the place of the purple melastoma, a large white lily that of the liliaceous sayri-sayri; while the gaultheria, lycopodia, and gallia appear to be almost identical in the two regions. The vegetation of the interior of the ravine also resemble that of the pajonales of Sandia to some extent. It contains osbeckias,

osbeckias, holly, cinnamon, michelias, vaccinium, sapota, &c., with an undergrowth of lobelia, acanthus, and ferns, and nine species of cinchonaceous shrubs. The temperature appears to be almost identical with that of the pajonales above the valley of Sandia, in Peru, and the spot receives a moderate supply of rain and mist during both monsoons. It is true that this wooded ravine is more elevated, by nearly 1,500 feet, than any point in Caravaya where I found the cinchona growing; but Ootacamund is more than two degrees nearer the equator, and the temperature of the two places appears to be nearly the same. It is no small advantage, too, that the ravine is so near the Government gardens, and that the cinchona plantation will thus have the benefit of Mr. McIvor's constant supervision.

8. These are my reasons for believing that the site already chosen will be suitable for the cultivation of *Cinchonæ*. The Madras Government has sanctioned a grant of 2,000 rupees for clearing the portion of the ravine intended for cultivation, and for making a cart track to Ootacamund; and Mr. McIvor has made an excellent suggestion (to plant the spaces between the Cinchona trees with peppermint; the essence to be prepared and sold, so as to meet the expenses of keeping up the plantation, in the interval that must elapse before the Cinchona trees can become profitable), which has also been sanctioned.

9. While believing that the site already selected will be found well adapted for the cultivation of the *Cinchonæ Condaminea, ovata*, and also of the *Calisaya*, especially in its shrubby form; I yet consider it very important that another experiment should be tried at a lower elevation, more particularly if, as I fully expect, the *Cinchonæ micrantha* should be amongst the species which are expected to arrive from South America. I intend to go with Mr. McIvor to select a site for this purpose, somewhere in the direction of the Wynaad hills, as soon as the weather becomes finer.

10. When the cinchona becomes a cultivated plant, there is every reason to believe that, like coffee, and I believe cinnamon, it will be found most profitable to grow it in its shrubby form; that more bark will be obtained from the shrubs than from trees, occupying the same space of ground; and that the shrubs, from being grown at a greater elevation, will yield a larger percentage of alkaloids. There will, at the same time, be a stronger inducement to undertake the cultivation as a shrub, because the plantations will be necessarily in much healthier situations. The natives of this country, as well as those of Bombay, are fully alive to the value of quinine; and it is probable that they, as well as European settlers, will hereafter be willing, and even anxious, to cultivate the plants which yield it.

11. With reference to a paragraph in Mr. Merivale's letter to me, dated the 11th of August 1860, I propose, "in order that the experience I have obtained of the situations peculiar to the various species of the cinchonas may be turned to the greatest possible account," to visit the Pulney hills, in Madura, those on the borders of Tinnevely and Travancore, those of Wynaad and Coorg, and those of Mahableshwur, in Bombay, with the view of ascertaining whether any or all of these are suitable for the cultivation of the cinchona plant. I trust and believe that my observations will prove useful hereafter; though at present, on account of the absence of settlers, and from other causes, there may be little prospect of Cinchona plantations being soon established in some of the above-named regions.

— No. 59. —

From C. R. Markham, Esq., to J. D. Sim, Esq., Acting Secretary to Government, Revenue Department, Fort St. George; dated Ootacamund, 30 December 1860.

Sir,

1. WITH reference to an article in the "Madras Daily Times," mentioned in an order received by Mr. McIvor to report upon the state of the cinchona plants, I consider it right to address the following remarks to you, for the information of the Governor in Council. I am told that the article in question, which has

attracted the notice of the Government, is intended to convey the idea that the service upon which I am employed will end in failure; and I address the following remarks to you, in order to give the Government the assurance that, humanly speaking, it is scarcely possible that such can be the result of the experiment the conduct of which has been entrusted to me.

2. When I was appointed to perform this service, I took measures to procure plants and seeds of the four most valuable kinds of cinchona bark known in commerce—namely, the *Calisaya* or yellow bark, the grey and crown barks, and the red bark.

3. The trees yielding these barks grow in regions separated by many hundreds of miles from each other. I undertook to procure the *Calisaya* species myself, and entrusted the collection of the other species to agents thoroughly qualified for the work.

4. The Government is aware, from my report, dated June 1860, that, after much difficulty, I succeeded in embarking upwards of 400 *Calisaya* plants in good condition, at the Peruvian port of Islay, a considerably larger number than was collected by M. Hasskarl for the Dutch Government. Unfortunately, no steamer was provided in the Pacific to convey the collection by a direct route to India; and it became necessary to take it by the circuitous route of the West Indies and the overland journey to Calicut. The extreme heat of the Red Sea must have done the plants much injury; as at the time they were in England, they were seen by Mr. Veitch, and by the foreman at Kew Gardens, who considered them to be in excellent condition. In my report, dated 20th October 1860, I stated that, on the arrival of the plants at Ootacamund, the roots were all decayed, but that Mr. M'Ivor had obtained 207 green cuttings, and 125 wood cuttings, from which all decayed parts which were visible had previously been carefully removed. I added, that 50 of the green cuttings had already begun to show signs of growth, as well as 10 of the wood cuttings.

5. I regret to say that the strong hopes which we then entertained have been disappointed. The green cuttings subsequently went off, as well as many of the wood cuttings; and Mr. M'Ivor considers that they must have been all more or less tainted by decay. A few of the wood cuttings are still alive and green, and some of them may eventually grow, though I scarcely think it probable.

6. But my object in writing this letter is to give the Government the assurance that the success of this very difficult and important experiment does not depend on the plants which have already arrived, and that disappointment, in one or more instances, is a very different thing from the entire failure of the attempt to introduce these inestimable plants into India.

7. With regard to the *Calisaya* species, in the event of our losing all the plants now at Ootacamund, such a calamity will by no means involve failure. I left 17 young *Calisaya* plants at Kew Gardens, and Sir William Hooker has succeeded in procuring four or five *Calisaya* plants raised from seeds formerly transmitted by Dr. Weddell, from which he has struck cuttings; so that next year a second supply of cinchona plants of the *Calisaya* species will be forwarded to India. I have also taken measures to procure a supply of *Calisaya* seeds from Peru; and if my agent should fail me, I am acquainted with others, residing on the spot, whose services I shall be able to obtain, to collect and transmit seeds next season. Thus, it will be seen that the successful introduction of the *Calisaya* species is not dependent on the plants which have already arrived; and the same remark is equally applicable to the species yielding grey and red bark.

Calisaya species.

8. I employed an agent to procure seeds and plants yielding the grey or crown bark of commerce, who has succeeded in performing that service, and his collection has already arrived at Bombay. The grey barks sell at a high price, and are much used in the form of decoctions and infusions. Of the plants yielding this bark, 56 arrived at Southampton last October, eight of which were dead, and were left at Kew Gardens, and the remainder, "being good strong plants, and apparently well rooted,"* were forwarded to India. These plants arrived at Bombay on the 15th of December, having been delayed very much, from some cause as yet unaccounted for. I am sorry to have to report that, on their

* Report of a gardener sent from Kew, to examine these plants at Southampton.

their arrival, all except six were found to be quite dead, and that those which retain life are reported to be in a precarious state. But as with the *Calisaya* species, so with those yielding the grey or crown bark, one disappointment is very far from involving the failure of the experiment.

9. A box of seeds of the grey bark species is now on its way from Bombay, and I have no doubt that Mr. Melvor will be successful in rearing them. A portion of these seeds will be transmitted to the Government Gardens in Ceylon. Seeds have also been sent to the islands of Jamaica and Trinidad, where they will be raised in the hill districts; and from thence, if the seeds now on their way to Ootacamund should fail (which there is no reason to expect), young plants will hereafter be forwarded to India. Cuttings also may possibly be struck from the two plants left at Kew.

10. The species yielding the red bark of commerce, which is only second in value to *calisaya*, and which, according to the latest market prices in London, is now more esteemed than any other species, will also be introduced into this Presidency. I engaged the services of an agent to collect plants and seeds (of the *Cinchona Condamina* and of the species yielding red bark), who is well known as a botanist, and is eminently qualified, in all respects, for the undertaking. No tidings have yet arrived of the approach of his collection; but 15 cases of plants and a supply of seeds may now be expected in India by every mail. Portions of the seeds of these species, also, will be left at Jamaica, Trinidad, and Kew Gardens, so as to insure the experiment from possible failure.

Species yielding
red bark.

11. It will be seen, by the above remarks, that one or two disappointments were from the first anticipated, but that so many precautions have been taken to prevent the entire failure of this most important experiment, as to render it, so far as human means can avail, almost impossible. The successful propagation of the cinchona, from any plants or seeds which arrive in a healthy condition at Ootacamund, is ensured by the skill and experience of Mr. McIvor.

12. I remain at Ootacamund until the arrival of the cinchona seeds, now on their way from Bombay. I shall then return to Bombay, by way of Coorg and Wainád, previous to my departure for England; and from Bombay I shall have the honour of transmitting to you, for the information of the Governor in Council, a copy of the final report which it will be my duty to address to the Under Secretary of State for India, after having examined the hill districts of the Neilgherries, Pulneys, Wainád, Coorg, and Mahableshwur.

— No. 60. —

From Dr. Macpherson, Inspector General of Hospitals, to the Secretary to the Principal Inspector General, Medical Department.

Sir,

Madras, 10 December 1860.

1. In my letter No. 42, dated Singapore, 1st September last, I reported to the Principal Inspector General that an unforeseen detention in the Straits Settlements determined me to proceed to Java, with the double object of procuring a passage to Labuan, and personally to examine into the mode of culture and propagation of the cinchona tree, which I understood had been successfully introduced into that island from South America.

2. On the 20th October following, I reported that I had failed to get a passage to Labuan, but that I had free access to the Government cinchona plantations and nurseries, and that it was my intention to embody the knowledge I had acquired regarding the culture and propagation of this valuable tree, in a translation from the Dutch of a pamphlet entitled, "Kina Kultur in the Island of Java," presented to me by the authors, Drs. Junghuhn and DeVrij, two gentlemen in the service of the local government, in special charge of the plantations.

3. I am now engaged in drawing up a report in reply to the queries of the Royal Commission on the sanitary state of the Indian Army. On the completion of this work, it will be my duty to inspect the military establishments in the province of Pegu. But before proceeding thither, although I have not yet

received the treatise referred to above, I will without further delay convey to the Principal Inspector General, for the information of Government, the result of my observation and inquiries, as these may be of some service in advancing the active endeavours now being made to naturalize on our mountain ranges probably the most important genus in the whole Botanical Materia Medica.

4. The medico-botanical history of cinchona, introduced into Europe in 1640, is still imperfectly understood, and all relating to it continues a subject of intricate and important inquiry. Of the 26 species admitted, 12 furnish a part of the barks of commerce. They are all either tall shrubs, or lofty evergreen trees, adorned with beautiful shining leaves, two inches long by two broad, rising from 30 to 40 feet in height; the older and thicker stems have now become scarce; those now found seldom exceed six inches in diameter; but when protected by dense forest, they rapidly run up to 40 or 60 feet in height.

5. The tree is supposed to be indigenous in a meridional distance through Columbia, Peru, and Bolivia, extending from the 11th degree north to the 20th degree south of the line, growing on rich surface-mould, covering a substratum of mica slate and gneiss, at an altitude of from 4,000 to 8,000 feet above the sea, where the temperature is equable, and varies between 59 and 66 degrees of Fahrenheit.

6. The cascarilleros or peelers usually destroy the tree by stripping off its bark as it stands; whereas were they to cut it close to the ground, young shoots would spring up, which would in their turn become fit for peeling in from six to twenty years. This reckless destruction, coupled with the enormous demand for quinine in Europe, has occasioned so great a scarcity, that the authorities in Upper Peru contemplate placing an interdict on the exportation of bark for a series of years. It is asserted that 800 to 900 trees are cut down in order to furnish 11,000 pounds of bark, and that 25 to 50 ounces, or $1\frac{1}{2}$ to 3 per cent., are the two extremes of quinine from 100 pounds. The sum expended by the Indian Government in the purchase of this valuable medicine is stated to exceed five lacs of rupees annually. Madras consumes, on an average, 2,090 lbs. of bark and 451 of quinine. Great Britain imports annually about 400,000 lbs. of bark, and retains towards 120,000 lbs. for home consumption.

7. In the year 1852 M. Hasskarl was commissioned to proceed to Bolivia by the Dutch Government to procure specimens of the cinchona tree. He was unable to penetrate into the forests, but both plants and seeds were conveyed to him by the cascarilleros or bark collectors. The only knowledge, therefore, which this gentleman acquired regarding the growth of the plant, &c., was from these individuals. He arrived in Java in December 1854 with 21 boxes, containing the five species of the tree noted in the margin, and also a supply of seed belonging to each species.

Cinchona Calisaya.
 " Lacumaefolia.
 " Lanceolata.
 " Succirubra.
 " Lancifolia.

8. He selected for his plantation the slope of the Geday mountain, about 100 miles from Batavia, varying in elevation from 3,500 to 4,500 feet above the sea, which he effectually cleared of forest: only one seed out of 1,000 germinated, and most of the young trees on being planted out speedily died, and of all the trees imported only two survived. Ignorant of the habitudes of the plant, three mistakes were committed:

(1.) The elevation was insufficient.

(2.) The ground should not have been cleared, for the fungi generated by the decaying roots of the forest trees proved pestilential to the growth of the cinchona tree, as is shown in the specimen of the root herewith sent of one that struggled on for six years.

(3.) The superficial vegetable mould being too light, the tender roots were unable to penetrate the volcanic turf beneath, so spread out horizontally, which checked their growth. This, however, turned out a most fortunate mistake, for the trees, although stunted in growth, and made to resemble the artificially formed dwarf forest trees found in Chinese gardens, being thus forced into early maturity, flowered and seeded freely.

9. The Government of Netherlands India felt that hitherto they were experimenting in the dark. To guard, therefore, as much as possible against further failure, they nominated on liberal salaries Dr. Junghuhn, a gentleman of

of distinguished scientific attainments, and an eminent naturalist, as sole custodian over the Cinchona plantations, and associated with him, Dr. De Vrij, an accomplished professor in chemical and agricultural science in the University of Leyden, to analyse every plant that died, with reference to the quantity of the valuable alkaloids contained in each, the soil producing them, &c., so as to trace all that was hurtful to their growth, and to arrive at some sound conclusion respecting the proper elevations for their propagation.

10. Complete success may now be said to have rewarded the labors of these gentlemen; many of the old plants were carefully removed to new localities more inland, numerous cuttings were secured from others, and much care was devoted to the germination of the seedlings from the seed referred to in paragraph 3. In the margin is given the number of healthy young trees planted in six different forests: there are besides well-stocked nurseries, and a good supply of seed in hand.

Cinchona Calisaya	15,819
„ Lucumæfolia	9,20,068
„ Lanceolata	45
„ Succirubra	35
„ Lancifolia	14
Total	9,35,981

11. For the nurseries, a sheltered part of the forest is selected and cleared sufficiently for the erection of ranges of narrow ridge roofed nurseries, open on both sides. Here beds are formed, and scaffolding for pots or cut bamboos for the seed raised fully 18 inches from the ground. The mould is a rich coffee coloured or black, freed from all decaying or dead roots, leaves, &c., and without manure or other artificial substance. The seed which does not exceed a carroway seed in size, is placed on the surface of the mould, watered twice daily from the squeeze of a sponge, and not exposed to the sun until it has germinated, when the sun is admitted from 6 to 8 a.m. If too much water be given, cryptogams destroy the seed, and the plant is so tender that a slight touch will destroy it as it sprouts. Under favourable circumstances the seed germinates in five to six weeks. But they should never be thrown away, until by the aid of a glass the seed is found to have decayed, for they have been known to germinate after a year's exposure on the soil.

12. Less water is now required for the young plant, which should remain in pots from six to 12 months, according to their vigour or otherwise. They should never be planted out until they have attained a length of at least six inches, and look strong and healthy. Cuttings are treated in the same way. But they are more difficult to deal with than seeds, and never make such good trees. The tree thrives best in the densest forest, and the southern decline of hills is that most suitable for its growth. The best forests are those which have the largest trees, and especially where the *Quercus Fungiformis* is found, a tree of the beech species, having powerful buttresses, and attaining great height.

13. Nurseries succeed best at, or under 4,000 feet. The Cinchona Calisaya grows only between 5,000 and 5,800 feet. The other species will flourish at a greater elevation. Those planted under 5,000 feet yield little quinine, but the best elevations have yet to be ascertained. The tree is at first very slow in growth, but when it has taken root and gains strength, it springs up rapidly. Holes three feet every way should be dug, and the mould freed from stones and foreign substances, replaced and raised like an inverted saucer, so as to let the water run freely off from around the stem of the plant. The holes should be in concentric circles through the forest, *i.e.*, from a given line, circles are formed, and sufficient only of the forest is cleared in order to be able to replace the plants if necessary, remove the weeds, &c. Each tree is distant 15 to 20 feet, according as the ground is available; at first they were protected by a bamboo fence; but now the Cinchona plantations, having extended over so many hundred acres, simple bows are placed around and tied at the top to protect the plant from injury from wild animals, &c. An insect, a kind of *darmestes*, about the size of the head of a pin, sometimes works into the medulla, where it deposits its egg and kills the young plant.

14. Chemical researches have shown a considerably larger amount of quinine in the plants grown in the Island of Java than in any yet imported from South America. As shown in paragraph 6, three per cent. appears the largest average in the latter, whereas five per cent. was discovered in the former, the alkaloid being present in the leaves and roots as well as in the bark of the stem, which is an encouraging assurance of success. Overseers, usually steady old soldiers, are placed in charge of the plantations; the 1st class receive 125 rupees, the 2d

100 rupees, and the 3d 75 rupees per month. From 200,000 to 300,000 plants are the fixed number in each plantation.

15. My hurried departure from Singapore did not enable me to procure the necessary letters of introduction to officials in Java, a point of etiquette absolutely necessary when information is sought, nor did my short stay in the island give me sufficient time to make the full observations I desired. I did my best to procure correct information, but I may be in error in some of the particulars above recorded. Had I gone there commissioned by Government, with proper documents, I might have secured from the authorities both seeds and young plants for experiment on our mountain ranges, which would be much more likely to succeed than any direct importations from South America.

16. I am confirmed in this latter assurance, by the receipt this day, of a communication from the British consul in Batavia, through whose influence, when there, I endeavoured to procure a supply, of which the following is an extract:—

“Although you did not take the right way to procure quinine plants, you had hardly left the island when all began to regret their apparent churlishness. If you get the Governor of Madras to address the Governor General of Netherlands India personally, requesting a supply for an experiment on your mountains, and offering in return any of the products of India that he may desire, the supply will be granted.”

17. Having been over the chief mountain ranges within the Presidency of Madras, I was to some extent in a position to contrast their physical aspect with the features of the elevated forest lands which have proved successful for the growth of the *Cinchona* tree in Java. The climate and soil too on our hills, I conceive to be equal for this purpose to anything observed in that island. I believe also I am correct in stating that the *Cinchona excelsior* is indigenous in some of our forests, circumstances which may be considered to augur favourably for the success of the earnest endeavours now in progress to naturalize the tree in India.

18. I am impressed with the conviction that the same success which has rewarded the unremitting exertions of the Dutch in Java ought also to attend similar efforts on the part of our Government. I trust I may be excused for suggesting that immediate advantage be taken of the liberal offer conveyed to me through the British representative in Batavia. It has been through the exertions of his Excellency, first as Minister for the Colonies at the Hague, and second as Governor General of Netherlands India, that the experiment which forms the subject of this letter, was entered on and brought to a successful issue, and I have no reason to doubt the sincerity expressed in a desire to reciprocate the respective advantages possessed by the two countries.

19. The 77th and following paragraphs of Mr. Markham's letter to the Under Secretary of State for India, dated Peru, 9th June 1860, refers to expected supplies of seed and plants from South America. His Excellency the Governor will observe from this report that no ordinary amount of care is necessary, in all stages of its growth, to habituate the plant within our tropics, and he will doubtless direct such measures to be carried out, prior to their arrival, as to the selection of site, preparation of mould, formation of nurseries, &c., &c., as will aid in the success of the experiment.

— No. 61. —

LETTER from *C. R. Markham, Esq.*, to the Under Secretary of State for India.

Sir, *Bombay, 26 February 1861.*

IN this letter I propose to submit, for the information of the Secretary of State for India in Council, a report of the present prospects of the experiment now in process for the introduction of *Cinchona* plants into India; of my proceedings during my stay in India; and of the conclusions I have been led to form, respecting the measures which it will be advisable to adopt in order to ensure the success of

of this important attempt. It is my intention to return to England by the steamer which leaves Bombay on 12th March.

2. It is with deep regret that, in the first place, I have to report that the sanguine hopes of the final recovery of the collection of plants which arrived in the Neilgherry Hills last October, prematurely expressed in my letter dated 20th October 1860 (No. 7), have been disappointed. I will recapitulate the prospects, as they now appear, of successfully introducing the various species of *Cinchonæ* into India; and, though as regards the plants and some of the seeds which have already arrived they are sufficiently unpromising, it will be seen that there is no reason to apprehend the eventual failure of the experiment.

3. The species which it is intended to introduce into India are,—I. the *Cinchona Calisaya*; II. those yielding grey bark; III. those yielding red bark and the *C. Condaminea*; and IV. those which yield the barks imported from New Granada. I will notice these in their order.

4. I. The *C. Calisaya*.—In my Letter, dated 20th October 1860 (No. 7), I reported that, out of the collection of plants which I conveyed to the Neilgherry Hills, Mr. M'Ivor had obtained 207 green cuttings, and 125 wood cuttings, from which all visible appearances of decay were first carefully removed. I added that, during the first week, upwards of 50 of the green cuttings, and 10 of the wood cuttings were showing signs of growth, and that success was certain. My conclusion, partly dictated by the intense anxiety I felt on the subject, was premature. On the four days following the despatch of my letter, there was incessant rain accompanied by heavy mist; the atmosphere of the gardens resembled that of the interior of a Wardian case, and the green cuttings all began to droop and look sickly. Every endeavour was made to save them, two Waltonian cases were constructed, in order to subject some of them to a bottom heat of 75 degrees, and force them to take root; but warmth, though it tends to draw out the roots of cuttings, also increases the rapid spread of decay if any exists, and this experiment was, therefore, only tried on a portion of the cuttings. In spite of all our efforts, the green cuttings went off one after the other, the last one lingering until late in November. The wood cuttings continued to look promising for a considerable time longer; but decay made its appearance in them also, a fatal taint seemed to pervade them all, and, when I finally left the Neilgherry Hills, on the 10th of January 1861, only eight retained life, of which one, *C. Calisaya*, had a green healthy looking bud, and was very promising. It was healing over the portion of the bark which had been cut, a thing which none of the others had ever attempted to do. In a letter, dated 10th February, Mr. M'Ivor tells me that these surviving cuttings remain nearly in the same state, but that a little decay is making its appearance here and there in some of them; so that I am unable to entertain hopes of the ultimate recovery of more than one.

5. On my arrival at Alexandria, 175 of the plants were covered with leaves and green sprouts, and were looking fresh and healthy; so that the mischief must have been caused by the intense heat of the Red Sea, and of Bombay during the six days that I was delayed there. It is much to be regretted that a steamer was not furnished, to convey the collection direct from the west coast of South America to India. I feel certain that, in that case, a great number of plants would have been saved; though it is right to add that, out of the 400 *Cinchona* plants procured by M. Hasskarl for the Netherlands Government, which had the advantage of being conveyed by the direct route to Java, only two have survived.

6. The loss of the *Cinchona* plants, which I had collected with so much labour and difficulty in the Peruvian forests, is most disastrous, but not I trust irreparable. Before leaving England, I sent 17 small *Calisaya* seedlings to Kew, respecting which Sir William Hooker says, in a letter, dated 8th January 1861, that two continued to show signs of *real* life, though he did not expect to keep them through the winter. In a letter, dated 18th August 1860, he informed me that he had obtained five plants of *C. Calisaya*, which had been in gardens in England for some years, from which he was striking cuttings. There is reason to hope, therefore, that a case of *C. Calisaya* plants may be sent to India, at the same time with the seedlings raised at Kew from the seeds of the grey and red barks. I also think that I shall be able to procure a supply of seeds of the *C. Calisaya* from South

America, by means of the 50*l.* which has already been sanctioned for that purpose; and there is a prospect of the Netherlands Government in Java being induced to exchange some of their plants of *C. Calisaya* for those of species which we possess and they do not, a subject on which I shall submit some further observations presently.

7. II. *The Cinchonæ yielding Grey Bark.*—The collection of plants and seeds of *Cinchonæ* yielding grey bark made by Mr. Pritchett in the forests of Huanuco arrived in England in October; and a gardener from Kew reported that “46 were good strong plants, apparently well rooted.”* Two of the plants and a portion of the seeds were left at Kew Gardens; the remaining plants and seeds being despatched to India on the 10th of November. They arrived at Bombay on the 13th of December, when Dr. Birdwood, who was directed to examine them by Sir George Clerk, found the seams of some of the cases gaping, the soil utterly parched and dried up, “just like powder in a druggist’s shop,” and the plants in a hopeless condition. All, except six,† were quite dead, several being mere cuttings without the sign of a root, and one a small branch torn roughly from a tree, and stuck in the soil of the case. The six survivors had the pith discoloured and the bark soft, and Dr. Birdwood reports that the dead plants in the cases appeared to have lost all life for at least three or four weeks.

8. At the same time, a packet of seeds of the *Cinchonæ nitida, micrantha*, and of the variety of *micrantha* known to the bark collectors as “*Pata de Gallinazo*,” arrived at Bombay, but did not reach Ootacamund until the 13th of January, when they had lost their vitality, and Mr. M’Ivor entertains no hope that any will come up. He has sent a portion of these seeds to Ceylon.

9. Nevertheless, there is every prospect that the grey bark species will eventually be introduced into India; as the seeds left at Kew are coming up in great quantities, and the seedlings will probably be ready for transmission to India in the course of next autumn.

10. III. *The Cinchona yielding Red Bark and C. Condaminea.*—I have received copies of Mr. Spruce’s Report, and have felt much pleasure at the great ability, perseverance, and zeal, with which he has conducted the service entrusted to him. I have also heard from Sir W. Hooker, in a letter, dated 8th January 1861, that the supply of seeds sent to Kew by Mr. Spruce are doing well, many having already germinated, and that three tin cases of seeds, since transmitted by Mr. Spruce, reached England early in January, and will be forwarded, some to India and some to Ceylon, without delay. These seeds have arrived at Bombay in good condition, and have been despatched by post, to Ootacamund. I trust that Mr. Spruce will not forward the cases of plants until the severity of the winter in England is passed.

11. Mr. Spruce reports that he was unable, during the season of 1860, to take any steps for the collection of seeds and plants of the *C. Condaminea*; but the Secretary of State in Council will probably authorise him to do so, during that of 1861.

12. IV. *Cinchonæ which yield the Barks imported from New Granada.*—It will, perhaps, be remembered that, respecting the region of New Granada, one of the four from which I considered it advisable that the different species of *Cinchonæ* should be procured, a letter was addressed to the Colonial Office, but that no steps were taken by that department to procure the species of New Granada. I now find that that eminent botanist, Dr. Karsten, presented some seeds of the *Cinchona Condaminea* (var. *δ lancifolia*), one of the New Granada species, to the Dutch Government, and that there are now 14 healthy young trees of that species in Java, some of which might be exchanged for a few plants of species which we possess, and which the Dutch have not. I now propose to submit a few remarks on the letter of Dr. Macpherson, Inspector-general of Madras Hospitals, to the Secretary to the Principal Medical Inspector General, dated 19th December 1860 (No. 50), reporting his visit to the *Cinchona* plantations of Java; ‡ especially with respect to procuring this New Granada species, and, perhaps, some plants of the *C. Calisaya*, by a system of exchange.

13. Dr.

* Report dated 20th October.

† Since dead.

‡ Proceedings of Madras Government, 11th January 1861, Nos. 166 and 167.

13. Dr. Macpherson supplies a few particulars respecting the cultivation of Cinchona in Java, in addition to those already given from Dr. Junghun's Report, translated in my pamphlet ("Notes on the Culture of Cinchonas"); but Mr. M'Ivor assures me that the system of culture adopted by the Dutch is most erroneous (as described to him by Dr. Macpherson), and as the sites selected by them in Java were not chosen by any one who had visited the Cinchona forests of South America, little dependence can be placed on their suitability, while the Java experiment is as yet too recent to admit their superior knowledge on the ground of experience. Dr. Macpherson, however, quotes a letter from the British Consul at Batavia to himself, stating "that if the Governor of Madras addresses the Governor General of Netherlands India, personally, requesting a supply (of Cinchona plants) for an experiment in India, and offering in return any of the products of India that he may desire, the supply will be granted."* How far this liberality, on the part of the Dutch authorities, can be advantageously accepted by the Madras Government, is worthy of consideration. There can be no doubt that the Dutch have the *C. Calisaya* (15,819 trees) raised, partly from the two surviving plants brought by M. Hasskarl, and partly from seeds sent to Paris several years ago by Dr. Weddell; but I have reason to doubt whether they have any plants of the *C. succirubra*, the red bark species. Dr. Macpherson names that species among those in Java, and gives the number of trees at 35, but it is not mentioned in Dr. Junghun's report. Mr. Spruce is probably in a position to bear out my opinion that the Dutch are mistaken in supposing that they possess that species. We, however, now have a large supply of the seeds in India; and, as it is of equal value with the *C. Calisaya*,† the Dutch authorities, when they ascertain that they have not got it, will, probably be quite ready to exchange plants of *C. Calisaya* for those of so valuable a species. It will, of course, be unnecessary to make any application, unless our own endeavours to introduce the *C. Calisaya* end in failure.

14. The Dutch also have 14 trees of a New Granada species, the *C. lancifolia*, and they would probably be quite ready to exchange some of these plants for those of equal value which we possess in Mr. Pritchett's collection, namely, the *C. nitida* and *C. micrantha*.

15. The other species given in Dr. Macpherson's list are quite worthless. The *C. lucumæfolia* (920,068 plants) originally called *C. ovata* by M. Hasskarl, is of very doubtful character; and the *C. lanceolata* (45 plants) is probably not a Cinchona at all, the name not appearing in Dr. Weddell's list, nor in those of any of the established modern authorities.

16. If any proposal for exchanges should eventually be made, it will be very important that a person well acquainted with the appearance of the different species should be sent to receive the plants in Java, so as to prevent mistakes. This might be done by one of the gardeners who have been in South America, who will accompany the plants which will hereafter be sent from Kew to India, and whose services will be required at the Cinchona plantation in the Neilgherries.

17. I now proceed to submit the observations I have made, and the conclusions I have formed as to the suitability of the various hill districts in the Madras and Bombay Presidencies for Cinchona cultivation. Those districts are the Neilgherry Hills, Wynaad, Coorg, the Pulney Hills, the Anamallays, and Shervaroys, the hills near Courtallum in Tinnevely, and the Mahabaleshwur Hills in Bombay. I have examined all except the Anamallays, Shervaroys, and Courtallum, it being impracticable to form any Cinchona plantation in the Anamallays, for many years to come, as there are no European residents, and the Shervaroys and Courtallum not possessing sufficient elevation, and being ineligible from other causes.

18. *The Neilgherries and Wynaad.*—In my letter dated October 20th, 1860, (No. 7), I described the site already selected by Mr. M'Ivor, near the Government gardens at Ootacamund, and stated my reasons for believing that it will

prove

* Para. 16.

† Market prices in London in 1860.—*C. Calisaya* bark; 2 s. 8 d. to 3 s. per lb. Red bark, 3 s. 6 d. to 7 s. per lb.

prove suitable for the cultivation of those species of *Cinchonæ* which flourish at the highest altitudes, namely, the *C. nitida*, *C. Condaminea*, and a variety of the *C. Calisaya*.

19. Early in November, I went, with Mr. M'Ivor, in the direction of Wynaad, to select another site for a *Cinchona* plantation, at a somewhat lower elevation, and where the available land would be more extensive than in the ravine already chosen near the gardens. The conditions most favourable for the production of quinine in the bark of *Cinchona* plants are those of continuous vegetation, with a mean temperature of from 60 to 70 degrees of Fahr., varying according to the species, an almost constant supply of moisture, and an elevation of from 5,000 to 8,000 feet. In every part of the western ghauts the vegetation is subjected, during at least three months in the year, to an amount of dryness which is never known in the forests in South America; but I have seen no locality in India which more nearly meets the requirements of a *Cinchona* plantation than that which we selected on this occasion. It is, or was, within the Wynaad district, and the land belongs to the Nair Rajah of Nellamboor, in Malabar, who will be quite willing to let it to the Government; but it is in fact a portion of the northern slope of the Neilgherry Hills. The site is close to the travellers' bungalow at Neddiwuttum, near the crest of the ghaut on the road leading from Ootacamund to Manantoddy. The forest covers a declivitous slope, at an elevation of about 5,000 feet, and extends to the verge of the steep descent into the table land of Wynaad. There is a good supply of water in the forest, and the soil is rich, its base being a mixture of syenite and laterite, curiously combined in strata. In this forest, amongst other plants, I found the *Hymenodictyon excelsum* (called by Roxburgh *Cinchona excelsa*, but excluded from the list of *Cinchonæ* by Weddell), an *andromeda*, wild yam, cinnamon, pepper, coffee, wild ginger, an *osbeckia* with purple flowers, and numerous ferns and orchids. Moss, in great quantities was hanging from the branches and trunks of the trees, a sure sign of great moisture. This jungle is within the narrow limits of the region which receives the monsoons. Though protected, to some extent from the south-west, it receives a full share of the monsoon during the summer, and is also refreshed by the north-east monsoon, coming across Mysore, from October to December. During the remaining months it is not without mists and heavy dews in the nights, until the south-west monsoon again commences in May. Eventually, the plantation might be extended for a considerable distance to the east and south, at the same elevation, to the falls of the Moyaar, a tributary of the Cauvery, and even further still, in the direction of Kalhutti. The travellers' bungalow, which is never used, would be available as a residence for the gardener in charge of the plantation.

20. The road which passes by Neddiwuttum, leads to the coffee estates in Wynaad, of which there are now upwards of 40 belonging to European settlers; thus the planters will often pass the *Cinchona* plantation, and, when its success is secured, it is to be hoped that some of them will undertake the cultivation in the forest lands immediately above the line of their own coffee estates. Unfortunately, the coffee plantations in the Neilgherries are all on the southern side, near Coonoor and Kotagherry, which is too dry for the *Cinchonæ*, being outside the region of the south-west monsoon. The *C. succirubra*, yielding red bark, the *C. Calisaya*, and *C. micrantha* may all be cultivated in the forest which has been selected at Neddiwuttum.

21. *Coorg*.—Next to the sites selected in the Neilgherries, the mountainous district of Coorg appears better adapted for the growth of the *Cinchona* plant than any other part of the western ghauts. Tadiandamol, the highest peak of Coorg, is 5,780 feet, and its capital Mercara 4,500 feet above the sea. During January, February, and March scarcely any rain falls, but the valleys are seldom without moisture, and during my visit in January, heavy dews were frequent in the morning and evening, and at sunrise there were always long streaks of low-lying clouds resting on the sides of the ravines. At this season the belts of jungle, both on the Mysore and Malabar sides of Coorg, are scorched up with excessive dryness (a condition never known in the South American forests with which I am acquainted), but this was not so much the case in the loftier parts of the Coorg districts. In April and May there are frequent showers, from June to August the rain comes down in torrents, in September and October there are showers,

showers, in November Coorg receives rain from the north-east monsoon in small quantities, and December is foggy. The fall of rain on the western side of Coorg, the only part suitable for Cinchonæ, averages 150 inches. The mean of the thermometer at Mercara in 1836, during the hottest month, was 78 degrees, and during the coldest 63 degrees, the average temperature being about 65 degrees.

22. I examined the country in the neighbourhood of Mercara, and found a locality to which I had been directed by Dr. Macpherson, which is well suited for a Cinchona plantation. It is four miles from Mercara, by the side of the road to Mangalore. Its elevation must be a little over 4,000 feet, and the forest, about a mile long, extends in breadth from the road, down the steep sides of a ravine, to the valley at the bottom, which is bare of trees. It contains many tall trees, though not growing close, and the underwood is very dense, consisting of five kinds of ferns, a solanum, a lobelia, &c. There were also *cinnamon*, *hymenodictyons*, *tree ferns*, and *melastomaceæ*, and the general character of the flora appeared suitable for the growth of Cinchonæ. In this, the driest season, I found two small streams trickling through the underwood. Further down the Mangalore ghaut there are several flourishing coffee plantations, and when a Government Cinchona nursery is successfully established in their neighbourhood, the planters may also undertake the cultivation. There are probably many other sites equally suitable for the growth of Cinchonæ in Coorg, but none so conveniently situated as regards Mercara. Labour, as is also the case in the Neilgherries, is chiefly procured from Mysore, the coolies coming up after their own work is done.

23. *Pulney Hills*.—In the Madura district, the Pulney or Varragherry Hills, like the Neilgherries further north, branch out in an easterly direction, from the main line of the western ghauts. United to a portion of the Anaimalai range at their western end, they stretch out into the Madura plains for a distance of 50 miles, and average a breadth of 15 to 20. They are divided into two parts, a lower series of hill and dale to the eastward, averaging a height of 4,000 feet, where there is a great deal of forest, some cultivation, and several villages inhabited by people of the Velleler caste; and a loftier region to the westward, averaging 6,000 feet, with mountain peaks, the highest of which, Permanellie, attains an elevation of 7,500 feet. The formation consists of gneiss, traversed by veins of felspar, and the soil in the eastern part is a light reddish loam, yielding crops of garlick, mustard, two kinds of millet, besides groves of plantains, and lately the villagers have formed several small coffee gardens. In the western and loftier part, the soil is very poor, being a heavy black peat, several feet thick, with a yellow stiff clay as a subsoil. The rains on the Neilgherry Hills have the effect of mixing the decaying grass with the decomposed rock, and a rich soil is thus formed; but on the Pulneys this does not appear to be the case; the one becoming a black peat, the other a stiff clayey subsoil. These remarks apply to the interior valleys, but on the outer slopes, looking over the plains of Madura, there is a good soil in places, and magnificent forests at the foot of a perpendicular wall of gneiss, which forms the southern ridge of the Pulneys. There are also fine forests in the sheltered ravines, in which I observed trees of the following genera: *melicia*, *myrsine*, *rhodomyrtas*, *symplocos*, *bignonia*, *crotalaria*, *passiflora*, *osbeckia*, *jasminum*, *millingtonia*, *cinnamomum*, *dodonæa*, *monocera*, *sahota*, besides a variety of cinchonaceous shrubs, such as *hymenodictyon*, *hedyotis*, *lasianthus*, and *canthium*. Tree ferns abound near streams, and, like the Neilgherries, the grassy plains are dotted with tree *rhodadendrons*, *gaultherias*, *lobelias*, *hypericums*, and ferns. I was told that, during the season of the south-west monsoon, the Pulneys only receive passing showers, and in corroboration of this, I missed the *Berberis Mahonia*, a plant which, on the Neilgherries, is never found beyond the range of the south-west monsoon. The Pulneys, however, receive the full benefit of the monsoon from the north-east.

24. There are several damp, well-wooded ravines near the settlement of Kodakarnal, where the species of Cinchonæ, which prefer great altitudes, might be established. When these plants are thoroughly rooted in the Neilgherries, a few might advantageously be sent to the Pulney Hills, under the care of the gardener employed by the collector of Madura, Mr. M'Ivor having previously selected a suitable site. As the villagers have lately introduced the coffee plant,

it is not improbable that they might also be induced to undertake the cultivation of the plant yielding quinine, of the value of which they are well acquainted.

25. *The Anamallay Hills* probably possess several localities suitable for Chichona plantations, but being very feverish, and no European being yet established on them, it will probably be many years before they could be made available.

26. *The Shervaroy Hills*, in the Salam district, only attain a height of 3,000 feet, and, being quite out of range of the south-west monsoon, they are both too low and too dry for the growth of the Cinchona plant.

27. *The Hills near Courtallum*, in Tinnevely, enjoy the full benefit of both monsoons, but the highest waterfall at Courtallum is only 2,000 feet above the sea. Localities, however, may hereafter be found between Tinnevely and Travancore, with an elevation of 3,000 to 4,000 feet, where the *C. micrantha* and even the *C. succirubra* might thrive.

28. *The Mahabaleshwur Hills*.—The only part of the western ghats, within the Bombay Presidency, which attains an elevation sufficient for the growth of Cinchonæ, are the Mahabaleshwur Hills, the highest part of which is 4,700 feet above the sea, in latitude 18 degrees north. These hills are composed almost entirely of laterite, overlying the basalt of the Deccan; and the soil is exceedingly poor and shallow. The mean temperature of the hottest month is 73 degrees, of the coldest 62 degrees, the average for the year $65\frac{1}{2}$ degrees; but the climate, in every other respect, is most unfavourable. From October to the end of April scarcely a drop of rain falls, and everything is dried up, the Mahabaleshwur Hills receiving no portion whatever of the north-east monsoon, too wide an extent of land intervening between them and the Bay of Bengal. In May there are showers, and from June to September there is an unceasing deluge of rain, the fall being estimated at from 250 to 300 inches. The most essential requirement for the growth of Cinchonæ is a continuous supply of moisture; and in a climate where, for upwards of six months in the year, they would be exposed to excessive dryness, they certainly would not live. In addition to these climatic obstacles, there is a great want of forest trees in the jungles, which would supply a sufficient amount of shade, the vegetation of the scanty thickets consisting chiefly of such shrubs and small trees as *memecylons*, *jasmynes*, *indigoferas*, *cro-tolarias*, *eugenias*, with an undergrowth of *solanums*, *gentians*, *ferns*, and *curcumas*. I visited both Coorg and Mahabaleshwur in the driest and most unfavourable time of the year, but the advantage, both as regards vegetation and moisture, were incomparably in favour of Coorg; indeed, I should say that there was no part of the western ghats, of similar elevation, so entirely unsuited for the growth of Cinchonæ as the Mahabaleshwur Hills.

29. Ten miles to the eastward of the station at Mahabaleshwur, and immediately overlooking the valley of the Krishna, there is a place called Paunchganny. It is under 4,000 feet above the sea, entirely exposed to the cold east winds during the dry months, the surrounding hills are destitute of jungle affording suitable shade, and altogether it is the last place where Cinchona plants would be likely to thrive. I regret this, because at Paunchgunny there is a small experimental farm belonging to a retired apothecary of Sir J. Jeejeebhoy's hospital; application has been made for some plants, and no doubt all possible care and attention would have been bestowed upon them.

30. *Khasia Hills, Penang, Tenasserim*.—The Cinchona plant, in its native forests, is entirely confined to the tropics, and it seems likely that the greater variation of temperature in the extra-tropical regions would render any part of the Himalaya range unsuitable for its culture. Nevertheless, under cultivation, it may be found possible to extend the area of the Cinchona region, and the Khasia Hills, in the Bengal Presidency, where the necessary elevations can be obtained, may hereafter supply another site for a plantation, though, in the first instance, it would be imprudent to attempt the experiment in any other region than that which most nearly resembles the Cinchona forests of South America. In the Island of Penang, and in the Tenasserim Province, the necessary climate and elevation may also be found.

31. *Ceylon*.—On the whole, it will probably be found that the hill country of Neurellia, in Ceylon, which possesses the necessary elevation, and is within the region

region of both monsoons, will be found as good a locality as any which I have described in the peninsula of India; and I am glad to hear, from Mr. Thwaites, that many of the coffee planters are extremely desirous of trying the cultivation of cinchonas on their estates. Mr. Thwaites has received some seeds of *C. micrantha* from Kew, which have not germinated, and there is little hope that those sent him by Mr. M'Ivor will be more successful. A good supply of Mr. Spruce's seeds will, however, have reached Ceylon by this time.

32. In conclusion, I have to submit some observations respecting the measures it will be advisable to adopt in conducting the future operations connected with this most important experiment, the success of which will establish as a native of India the plant yielding the most valuable drug—as regards tropical countries—that is known in medicine, the supply of which now costs the Government upwards of 50,000 *l.* a year.

33. I would recommend that the experiment should in the first place, and until the propagation of plants by cuttings has rendered success certain, be confined to the two sites already selected, near the gardens at Ootacamund, and at Neddiwuttum, and that its management should be entrusted to Mr. M'Ivor, whose zeal, intelligence, and experience as a practical gardener, and knowledge on this special subject, probably exceed those of any other person to be found in India.

34. There is every reason to hope that, before the close of the year, Mr. M'Ivor will have, in the greenhouse at Ootacamund, a goodly supply of healthy young plants of the species of *C. Calisaya*, *C. succirubra*, *C. micrantha*, *C. Condaminea*, and *C. nitida*, raised from plants and seedlings sent from Kew, and from Mr. Spruce's seeds; and it should be remembered that, as regards the *C. Calisaya* especially, if only one or two good healthy plants could once be established at Ootacamund, it would be easy to propagate them, in two or three years, to almost any extent. The Madras Government has already made the necessary grant for expenses connected with clearing and planting the site near the gardens, and a similar grant will be necessary for the plantation at Neddiwuttum. As soon as the plants are sufficiently strong for planting out, it will be requisite that Mr. M'Ivor should be assisted by a European gardener, to be resident at Neddiwuttum; and he is now anxious that Weir, the gardener who went with me to South America, should be employed on that duty.

35. When I left Bombay in October, Weir was accidentally left behind; and as, on my arrival at Ootacamund, Mr. M'Ivor said that his services would not be required, I telegraphed to Bombay to have him dismissed and sent back to England. Unfortunately, he had already been despatched to Calicut in a native boat,* and having been three weeks at sea, eventually reached Ootacamund.† Regretting exceedingly the additional expense which this mistake has caused, I sent him back to Bombay, and he sailed for England on the 12th of January. Mr. M'Ivor, having fully instructed Weir in the best method of packing plants for long voyages, having demonstrated to him the errors usually committed by the nurserymen in England, and considering him a steady and honest man, who would be very useful to him when the plantations are fairly begun, is now very anxious that he should be sent out in charge of the cases which will, hereafter, be transmitted from Kew, and that he should be appointed as his assistant in the cinchona plantations. When the operations are extended, it will be of great importance to secure the services of Cross, the other gardener who has been in South America, to take charge of the plantation in Coorg, under Mr. M'Ivor's superintendence.

36. As soon as the plantations in the Neilgherries are thoroughly established, I would recommend that a third plantation should be formed in the forest already described in Coorg, on the Mangalore road, and in the vicinity of the coffee estates, and also that some plants should be established on the Pulney Hills, in charge of an intelligent native—Mr. M'Ivor having previously selected a site and given the necessary instructions. M. Levinge, the Collector of Madura, has expressed

* Letters to the Under Secretary of State for India from Bombay Government, General Department, Nos. 21 and 25 of 1860.

† Letter from Mr. Markham to Secretary to Government, Bombay, October 15th, 1860.

expressed his willingness to do all he can to ensure the success of the experiment. He tells me that, to the westward of Kodakarnal, he can find forests nearly resembling those of Neddiwuttum, and which receive the south-west monsoon; and thus, under his auspices, the experiment in the Pulneys would have every prospect of success. The staff eventually required for the conduct of the cinchona experiment would thus consist of—Mr. M'Ivor, to superintend the whole, especially the plantation near the gardens; two European gardeners, one at Neddiwuttum, and the other at Coorg; a native with some education on the Pulneys, and the necessary number of native overseers and labourers.

37. The large forest trees would, at first, be left standing in the plantations, to protect the plants from the sun, the gales of wind, and heavy rains; and further reflection has confirmed me in the opinion that it will be most advantageous to cultivate cinchonas as shrubs, in the same way as coffee and cinnamon, and not to allow them to run up as trees, for reasons which I have already stated in my letter, dated 20th October 1860 (No. 7). Mr. Howard, the quinine manufacturer, informs me that, though the large bark from trees is preferred, and yields rather the most quinine, the bark from small branches also commands a good price. Shrubs would, undoubtedly, suffer little from the bark being removed from their smaller branches, while large trees would never recover from the loss of the bark from their trunks; indeed, such a system would resemble that which has proved so destructive to the cinchona trees in South America. To cut the trees down, and trust to root-shoots springing up from the stumps, though not equally objectionable, would require a lapse of many years between the felling of one tree and the maturity of its offspring, and would, I think, be a most erroneous system to adopt.

38. As cinnamon is the only other plant which is cultivated for its bark, I have procured a few particulars respecting its culture in Ceylon from Mr. Thwaites. In the cinnamon gardens the young shoots are peeled twice during the year, at a particular period of growth, when the bark comes off readily. This particular time is known at once by the peelers, from the appearance of the young shoots, and the process of peeling is then a very expeditious one, with practised hands. Young plants are raised from seeds in nurseries, and planted three feet apart, when they are a foot or 18 inches long. They will commonly bear peeling in three or four years after being transplanted, if in a favourable locality, and properly attended to. The roots are earthed up frequently, to keep the soil loose and free from weeds.

39. From the Government cinchona grounds it may be expected that a considerable quantity of quinine-yielding bark will eventually be collected; and though the process of extracting quinine may be too difficult, and require too much skill, as well as expensive materials difficult of transit, to give any prospect of its being carried on *in situ*, there can be no reason why a manufactory should not be established in the Presidency town, so as to avoid the costly necessity of sending the bark to England. I have had conversations with many coffee planters on the subject, and I think it likely that, as soon as they know that the Government experiment has been successful, they will be willing to undertake the cultivation of cinchona plants on their own account; and for this reason it is an advantage that the Government cinchona nurseries should be in the vicinity of the coffee estates. Should this be the case, the cinchona would soon be as important an addition to the products of the hills, in a commercial point of view, as coffee has already become.

40. The impression that the natives can with difficulty be induced to undertake the cultivation of any new plant is certainly erroneous as regards Southern India. In Wynaad upwards of 2,000 acres is taken up for coffee cultivation by natives; in Coorg, where coffee was only introduced about six years ago, I scarcely saw a single hut to which a small coffee garden was not attached; and the villagers in the Pulney Hills have also commenced its cultivation. Maize is grown to some extent in Mysore, and the extent to which the cassava (*Jatropha manihot*), only lately introduced, is now cultivated in Travancore is quite remarkable. There is every reason to suppose that the natives will be equally ready to cultivate a plant yielding quinine, the value of which is so well known to them.

41. The seeds of the *chirimoya*, generally considered the most delicious fruit in the world, of the *aji* or Peruvian capsicum, and of the *Schinies molle*, which I brought



Enclosure in N° 61.

MOUNTAINOUS DISTRICTS
FITTED FOR THE CULTIVATION
OF CHINCHONA AND COFFEE PLANTS
IN
SOUTHERN INDIA

+ Sites selected for Chinchona
 Plantations.
 Coffee Plantations.

Signed,

Clements Markham

brought from Peru, are coming up well at Ootacamund. The *chirimoya* will probably succeed well at Bangalore, the *aji* in all the warm parts of India.

I have supplied Mr. M'Ivor with Dr. Weddell's "Quinologie," and with memoranda on the species of cinchonæ yielding red, grey, and crown barks, collected from the works of Humboldt, Ruiz and Pavon, Caldas, Poeppig, and others. It is important that he should also have Mr. Howard's work, now in process of publication by Lovell Reeve, of Henrietta-street, Covent Garden ("Nueva Quinologia de Pavon").

Copies of this report will be transmitted to the Governments of Bombay and Madras.

I have, &c.
(signed) *Clements R. Markham,*

— No. 62. —

From *D. Macpherson*, Esq., M.D., Inspector General of Hospitals, on special duty at Ootacamund, to *J. D. Bourdillon*, Esq., Secretary to Government, Revenue Department, Fort Saint George; dated Ootacamund, 5 February 1861.

Sir,

1. HAVING, pursuant to my instructions, dated 11th January 1861, No. 85, visited the Neilgherry Hills to inspect and report on the sites selected for an experimental nursery and plantation for cinchona plants and seeds expected from South America, I now proceed to state how far they resemble those which have proved successful in Java, and to make some general observations on the subject.

2. When *en route* to the hills, I had the pleasure of an interview with Mr. Markham, and received from him information regarding the habitat of the plant in its native country, which, with my inquiries in Java fresh in my mind, I have found useful in arriving at the results I am now about to record.

3. Three sites have been selected on the Neilgherry Hills for the quinquina (I use this term as, from its analogy to the active principle of the cinchona plant, it is that adopted in Java and by many of the best writers) plantations. I minutely explored these in company with Mr. M'Ivor, the superintendent of the Horticultural Gardens. The first is a scantily-wooded *sholá* embracing the sides of a ravine, having an eastern aspect, ascending from the Horticultural Gardens, and stated to embrace an area of 50 acres. The lowest part of this, the "Dodabet site," on which it is proposed to cultivate the plant, is 7,830, and the highest 7,950, feet above the sea; to this locality a road about six feet in width, and in length about one mile, has been partially constructed, and the underwood in the *sholá* is now being cleared. The chief attractions in this position are the numerous varieties of the cinchona family found there, and because of the altitude; for the best-informed writers allow "that the bark containing the largest amount of the alkaloid is obtained from trees growing at the greatest elevation, and that the stunted shrubby varieties of the plant, the cinchona *Calisaya Josephiana* for instance, which is found at an elevation of 9,500 feet, are particularly good when their growth is owing to the altitude of their position." But the same authorities inform us "that the best trees inhabit dense woods and aspire to rise above the tops of the highest trees;" and Mr. Spruce, engaged in collecting plants, &c., in South America, states, "that the finest trees grow in a stratum of yellow or reddish marl of immense thickness, and in which few or no stones were intermixed." Now, the site under review, although it possesses elevation, is wanting in luxuriance of vegetation; the forest trees are too cramped and scanty to give sufficient shade, the soil is generally a superficial superstratum of black vegetable mould on disintegrated granite, or on masses of trap protruding on the surface, and it is deficient in moisture. It bears no resemblance to those sites on which the plant flourishes in Java; and until we are in possession of plants of the *Calisaya Josephiana*, no further expense should, I think, be incurred on this spot.

4. As regards the important matter of the best elevation for the propagation and cultivation of the plant, I may here state that Humboldt and others give it a range in its native country of from 5,000 to 10,000 feet. Mr. Markham, at paragraph 19 of his Report to the Under Secretary of State, dated 9th June 1860, states, "I had but slight opportunities of observing the temperatures of the pajonal region about 5,000 feet above the sea, where the *Cinchona Josephiana* is found;" and in paragraphs 57 and 60, "the whole of the cinchouæ, with the exception of the *Josephiana* variety, have been collected in the valley of Tambopata, the height above the level of the sea being between 3,000 and 4,000 feet." Mr. Spruce, in the Appendix to his Report, speaks of "the Forest of Limon, on the western slope of Chimborazo, at about 3,000 feet in altitude, and that of Tabacál, near San Antonio, at an altitude of 2,600 feet," these being the two positions wherein he made the collection shortly expected here; and finally, in Java, the recognised elevations which a succession of experiments, conducted with much care for a period of seven years, have established, are, for the nurseries, between 3,000 and 4,000 feet only, while the plantations range from 3,000 to 6,000 feet. Now, with these facts before us, it must, I think, be admitted that we are risking our seeds and plants by attempting to propagate them in the Government Gardens at Ootacamund, the elevation of the lower greenhouse where they are placed being 7,478, and that of the upper 7,596 feet above the level of the sea.

5. To conduct the experiment with any prospect of success, I would urge the Government without loss of time to adopt the system now working so successfully in Java, and direct the preparation of nurseries under efficient superintendence on the sites selected for the plantations, and at the more moderate elevations than the Government Gardens afford.

6. In the selection of the sites, consideration was very properly bestowed on those adjoining the trunk-roads leading to the Neilgherry plateau. The second of these is the "Avalanche site," on the highway from Calicut, and 15 miles from Ootacamund: it commences north-east from the Travellers' Bungalow, distant about a mile, and covers an area of some 1,000 acres, nearly the whole of which might be made available for the varieties of the plant which inhabit the more elevated ranges in the Andes. The black superstratum of soil is rich and deep, generally free from stones; it is well watered, the vegetation is rich and luxuriant; the forest trees are of great size, abounding in rhododendrons one of which, at an elevation of 7,075 feet, in good health, I found to measure at two feet from the ground, 12 feet 9 inches in circumference, and more than 3½ feet in diameter; and the following varieties of plants common to the cinchona regions, and found also in the forests selected for the growth of the plant in Java: coffee, holly, ivy, cinnamon, tree-ferns, palms, peppers, blobberries, leseanthus, melestomaceæ (*Osbeckia*), magnolia, spoceneæ, and an undergrowth of ground orchides, ferns, acanthus, aroidæ, myrtaceæ, and small bamboos, with numberless gigantic climbers. The large trees are covered with moss and orchides, indications of humidity, and there are open well-sheltered glades, similar to the pajonal region where the *C. Josephiana* is found. The steep declivities which the plant prefers, sufficiently overshadowed by trees, are numerous, and the ravines indicate a subsoil of decaying schist much discoloured with red oxide.

7. The Avalanche Bungalow faces to the north, and the aspect of the forest is north-east and south-east; the former is unquestionably the best exposure in these latitudes. Because of the passage of the sun to the south during the dry and cloudless season, the rays fall direct on a north-east aspect; the very opposite state of matters have induced the Dutch in Java to select a southern exposure for their quinquina plantations. The parched appearance of the southerly and western aspects at this, the period of drought on the hills, the contracted circumference of the sholás, and the cramped vegetation on these, compared to that seen on the other surfaces, is of itself a sufficient indication that a northern and eastern exposure is that which holds out the best chances of success in the undertaking the Government are now entering on. The elevation of the Avalanche Bungalow above sea is 6,725 feet; the thermometer in the sun at 9 a.m. stood at 53 degrees; this may be said to be the lowest margin of the forest. The centre elevation is 6,740 feet, and the thermometer at 11 a.m. indicated

licated in the forest shade 65 degrees. On a grass ridge mid-summit, passing over to a scrubby sholá having a south-western aspect, the elevation was found to be 7,180 feet, and the thermometer in the sun 70 degrees at noon. The forest continues luxuriant to an elevation of 7,800 feet above the sea, when it ceases, the grass hill ascending about 40 feet higher; here the thermometer at 1 p.m., in the sun, indicated 74 degrees of Fahrenheit.

8. There is but one objection to this site, viewing it on the Java standard, viz., the want of a low elevation for nurseries; but otherwise there are so many well-protected favourable spots on the site for this purpose, especially with the aid of a glass-house, and the position appears to be so well adapted for the more valuable species of the plant, *i. e.*, the *Calisaya* and *ovata*, the Travellers' Bungalow in its proximity, in which the overseer in charge could reside, and the fact that a large burgher population, available as labourers, inhabit the vicinity, are circumstances which will weigh favourably with Government in according their sanction to establishing the "Avalanche site" as one of the proposed plantations. In elevation it is nearly equal to the "Dodabett site," far surpassing it in other respects, and there is another nearly equally extensive and in every respect favourable forest, descending to a lower elevation, about six miles from the bungalow.

9. I shall denominate the third situation selected for a quinquina plantation the "Neddivattam site," it being contiguous to the Travellers' Bungalow of the same name, 17 miles from Ootacamund, at the summit of the pass leading from that place to the western coast. This forest has also a north-east and a north-west aspect, and it covers an area of about 400 acres, in an undulating descent on the flank of the mountain, to the plateau land of Wainád. It shares in both monsoons, receiving a medium fall from each, a very desirable circumstance. In luxuriance of forest it is fully equal to that described under the "Avalanche site," and the flora springing up on every side promises equally well for the future success of the cinchona plant. Unfortunately, about one-half of this forest only is available; this half is strikingly illustrated by Mr. Spruce's words: "The finest trees grow in a stratum of yellow and reddish marl, of immense thickness, and in which few or no stones are intermixed." The main portion of the space is occupied by an avalanche, in which the whole of the surface soil from the highlands has been swept down and deposited a depth of from 50 to 80 feet. But nowhere in the better part of this space is the superficial rich, black, or coffee-coloured mould under 4 to 6 feet; the substratum appears to be granite and trap, in process of disintegration. A large stream passes down the centre of the space, entering from the summit, which can be conveyed in any direction for irrigation purposes. The prevailing undergrowth is that seen in the Andes, viz., the *Acanthus*, the *Meles-tomaceæ*, &c., and the exact same small fern which covered the plants imported by Mr. Markham. The *Hymenophyllum* grows on many of the forest trees. Elevated green hills protect the spot from the force of the south-west monsoon, and the trees increase in magnitude, and are overhung with rich drooping folds of moss in the more protected positions—indications of the humid character of the climate, and its germinating properties for nurseries. There is a very convenient elevated spur for overseers and storehouse about the centre, upwards of an acre in extent, having a full command of water.

10. The following give the barometrical and thermometrical indications on the 22d January 1861 :—

Highest Locality.

Greatest elevation on the forest skirt	-	-	-	-	6,150 feet.
At 9 A.M. thermometer on surface	-	-	-	-	67 degrees.
"	"	18 inches beneath surface	-	-	66 "

Spur for the House, &c.

Elevation	-	-	-	-	5,550 feet.
Thermometer in stream adjoining, 10 A.M.	-	-	-	-	54 degrees.

Centre Locality.

Elevation	-	-	-	-	5,220 feet.
Thermometer 18 inches beneath surface at noon	-	-	-	-	65 degrees.
"	on surface	"	-	-	68 "
"	4 feet above surface	"	-	-	73 "

Lowest North-east Aspect.

Elevation	- - - - -	4,530 feet.
Thermometer	18 inches beneath surface at 2 P.M. - -	73 degrees.
"	on surface " - -	71 "
"	4 feet above surface " - -	74½ "

Lowest North Aspect.

Elevation	- - - - -	5,430 feet.
Thermometer	18 inches beneath surface at 3 P.M. - -	73 degrees.
"	on surface " - -	71 "
"	4 feet above surface " - -	76 "

On the Andes in April and May, the mean of the observations given by Mr. Markham is 68 degrees, and from July to September that by Mr. Spruce is 66 degrees—the temperature of the earth 2 feet beneath the surface being 68½ degrees. The character of the soil generally on the surface is a rich black vegetable mould 18 inches in depth, beneath which is a fine, red, coffee-coloured, friable, porous marl; and thus the slope descends to the Wainád plain, where the elevation varies from 3,800 feet upwards.

11. The chief objection to this position is its limited extent; for a large portion of it, as already stated, is too stony for planting. But contiguous to, or rather adjoining on, it westward, with a similar aspect, is another forest equal in extent, and possessing the same character of flora and soil. This land is Mr. Ouchterlony's property; the possession of it would very much add to the value of the proposed plantation. On my intimating this to Mr. Ouchterlony, he generously offered to hand it over to Government, stating: "I regard the experiment to introduce the cultivation of cinchona into the country of so much vital importance, that I should be happy to assist it in any way in my power; and as you seemed to think the forest adverted to a desirable locality for it, I shall be willing to transfer my title and interest in the forest for the object of the cinchona plantation, should the Government desire to possess it." Mr. Ouchterlony's original note is enclosed.

12. Although the two sites just described have a striking resemblance to those which have proved successful under the Dutch Government in Java, they are wanting in the "trees, with buttressed roots of stupendous size," referred to in the 26th paragraph of Mr. Markham's report above quoted, and found throughout the Java forest plantations. Trees of this sort are common, however, on the Western Gháts; in the Annamully, and in the Coorg forests, which I have visited, where are found also "the wild plantain, gigantic climbers, and tree-ferns," found in the cinchona forests of South America and in Java. In a letter from Mr. Markham, just received from Mercara, he calls my attention to such a site "four miles down the Mangalore Ghát, where I came to the conclusion that it would be an excellent site for nurseries, better than any forest tract I have as yet examined to the south-east and south." When *en route* to the low country, I propose to visit this place; it will only take me a few miles out of my direct road to Madras, and I will then be able to speak of it from personal examination.

13. I take the liberty to submit, that the period has arrived for Government to determine on the extent to which this great experiment is to be conducted. As stated in my former report, the early endeavours of the Dutch in Java ended in failure, and so it continued until science and chemical research were called in to aid. With the exception of three cuttings made from the plants introduced by Mr. Markham, viz. :—

1. Cinchona Calisaya.
1. " " Josephiana.
1. " " ovata.

—which, under the skilful management of Mr. M'Ivor, superintendent of the Government Gardens here, may yet become robust plants—and the few left at the Royal Botanical Gardens, Kew, that gentleman's importation of 456 plants are dead. The collection of plants transmitted by Mr. Pritchett from Lima were dead on arrival at Bombay, and the valuable assortment of seeds forwarded by the same

same gentleman, comprising the varieties denominated the red, crown, and grey barks of commerce, or the—

Cinchona micrantha.
 „ *provinciana.*
 „ *nitida.*

are stated to have suffered a delay in their transmission to this place of six weeks at Lima, and 27 days at Bombay—a circumstance which, of necessity, must injure their vital property. Mr. Spruce, in his letter dated 12th October 1860, to the Under Secretary of State, at page 4 intimates the despatch, “by the steamer which leaves Guayaquil for Panama on the 14th October, a packet of seeds,” collected by himself, with much care; and four months have now nearly elapsed, without any intimation of its being received. I venture to suggest, that the Government address the Home and Bombay authorities on the necessity of expediting the despatch of plants and seeds in each case under the care of a competent gardener, whose services may be made available, if necessary, on the several sites selected for their propagation.

14. Mr. Spruce, botanist, now at Ecuador, writes to Mr. Markham on 5th July 1859: “The testimony of all the bark collectors goes to prove that the bark trees are rapidly verging to extinction. I am credibly informed that in some of the cinchona forests in Ecuador there does not remain a single tree large enough to produce seeds.” If, therefore, it be established that “the plant containing the most valuable medical substance the earth produces” will flourish on mountain ranges, at elevations from 2,600 feet upwards, according to Mr. Spruce’s statement, private enterprise will doubtless soon find it their interest to extend its cultivation, even although the prospect of remunerative return may embrace a term of seven years. But to establish this fact, Government must, I submit, as has been done in Java, be prepared to enter on the experiment with vigour, and simultaneously, in order to secure a better chance of success, to open nurseries and plantations in different localities. The scale I suggest for our immediate wants (and not a day should be lost in preparing nurseries—the most important, and, at the same time, the most difficult part of the undertaking), are the two plantations indicated on the Neilgherries, the one in Coorg, and hereafter another on the less accessible Annamullies, with efficient gardeners resident at each place, and overseers under them, together with an educated and intelligent botanist, possessing a knowledge of analytical chemistry, to conduct the whole. The services of John Weir, who accompanied Mr. Markham, ought, I think, to be secured. He has returned to England. He might come out in charge of some of the plants left at Kew Gardens. The services of Mr. Cross, the gardener who accompanied Mr. Spruce, will also be valuable in conducting the experiment. Apart from the interest which their researches may have created in them, numerous particulars regarding the growth of the plant in its natural state can be applied by them in its cultivation in this country.

15. I submit that in the new and difficult field of inquiry Government are now entering on, and the imperfect knowledge we possess of the chemical history of the quinquina barks, the employment of a superintendent possessing a special knowledge of the subject is of much importance. As a guarantee against mistakes, he ought to be provided with the means, by continuing analytical inquiry, to enable him to ascertain at what period the alkaloids develop themselves, and the constituents which add to or detract from this development. In connexion with this part of the subject, I take the liberty to introduce the name of Dr. Croneman, a young Dutch gentleman in private practice at Bandong in Java, in the neighbourhood of the quinquina plantations. This gentleman accompanied me over the plantations, and I was much pleased with his intelligence and general knowledge of all relating to the growth and propagation of the plant, and its chemical analysis. It was evident to me that he took a warm interest in the subject from a love of natural science alone; for I knew he held no appointment under Government, nor yet could he anticipate advancement through me. Subsequent inquiry through Dr. DeViy, Dr. Junghuhn’s coadjutor in charge of the quinquina plantations, satisfied me that this young man was much devoted to science, had a good knowledge of botany and geology, was a very fair draftsman, and, through Dr. DeViy, had acquired some knowledge in analytical chemistry. He possesses an imperfect knowledge of the English language so far as writing it, but can read and speak it with some freedom.

Without holding out any prospect of procuring employment for him under the British Government, before leaving Bandong I ascertained from Dr. Croneman that an engagement of the sort, which would advance his interests, would be agreeable to him. He promised to continue to devote himself specially to the subject on my informing him that, if an opportunity occurred, I would bring his name and qualifications to the notice of the Government of Madras. I hope I may be pardoned for now doing so, and also for the length of this communication.

Mr. Markham having applied to me for a copy of my former report, and also of any I may send in to Government from this place, may I beg you will obtain sanction to forward these to him to Bombay? I also solicit that a copy of this report may be sent to the head of my department, as I am unable to obtain a copyist here to prepare it. A small supply of seeds having been distributed by Mr. M'Ivor to parties at Bangalore, the Wainad, &c., I would suggest that my report on the cultivation of the cinchona plant in Java be placed on the editors' table for their information.

— No. 63. —

FROM *D. Macpherson, Esq., M.D.*, Inspector General of Hospitals, to *J. D. Bourdillon, Esq.*, Secretary to Government, Revenue Department, Fort Saint George; dated Mercara, 20 February 1861.

Sir,

1. ADVERTING to my letter to you, No. 7, dated 5th February, from Ootacamund, I have now to bring to your notice, for the information of Government, that having fully examined the site selected by Mr. Markham in this locality, I am enabled to report that it bears even a closer resemblance to the quinquina plantations in Java than the two sites which I approved of on the Neilgherry Hills.

2. The forest referred to occupies a position to the left, between the third and fifth milestones down the Mangalore Ghat from this place. The trees are of great magnitude, chiefly the open and continuous buttressed species, clustered with orchideous plants and rich drooping moss. Tree-ferns, small bamboos, cardamoms, and underwood, similar to that described in my former letter, give cover to a rich, deep, brown mould, free from stones. The forest trees are somewhat distant one from the other, and the foliage above is very lofty, so that, when the entire underwood is removed, there will be a free circulation, with abundance of light and shade. The ground undulates from ridges down into ravines, with running streams. These ridges average in elevation from 3,400 feet above the sea, the ravines gradually descending 100 to 150 feet. The temperature of the atmosphere at 8 A.M. in the sun indicated 85 degrees of Fahrenheit, in the shade four feet above the surface 69 degrees, in the surface 67½ degrees, and 18 inches beneath 61½ degrees—its aspect being N.E. and N.W.

3. Unfortunately, the extent of this forest is circumscribed, barely, I should say, 100 acres. But from its open character, it will receive a larger number of trees than a similar space on the localities examined on the Neilgherries; and its elevation, equable temperature, and genial climate make it a valuable locality for a nursery, and one of the earliest experimental plantations. Distant about three miles from this site, on the same side of the ghat, immediately above a coffee clearing by Mr. Bain, is a forest ascending up to 4,000 feet, and well adapted for a quinquina plantation, into which, as the space in that first referred to became occupied, trees could be introduced, with the same good prospect of success.

4. I beg to suggest that application be made to the Commissioner of Mysore, to reserve the above two sites for Government purposes, as otherwise they may pass into the hands of coffee planters, who, by felling the forest, would render it useless for the introduction of the cinchona tree.

— No. 64. —

FROM Captain *H. R. Morgan*, Officiating Conservator of Forests, to *J. D. Bourdillon*, Esq., Secretary to Government, Revenue Department, Fort St. George; dated Ootacamund, 1 April 1861.

Sir,

1. IN forwarding a letter * and tabulated statement from Mr. McIvor, Superintendent Government Gardens at Ootacamund, I have the honour to request you will submit it to Government for their decision.

* Dated 30th March 1861, No. 37.

2. As Dr. Macpherson has requested in his letter No. 7, dated 5th February 1861, paragraph 15, that his report may be laid on the editors' table, for the information of those who have obtained a supply of seeds, perhaps Government would have no objection to lay my report, No. 418, dated 28th March 1861, and the accompanying report of Mr. M'Ivor's, also on the editors' table, for the information likewise of those who have obtained seeds.

— No. 65. —

FROM Captain *H. R. Morgan*, Officiating Conservator of Forests, to *J. D. Bourdillon*, Esq., Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 28 March 1861.

Sir,

1. WITH reference to G. O. No. 552, of 9th March 1861, ordering all further propagation of seed to be put a stop to in the glass-house at Ootacamund, &c., I have the honour to request you will bring to the notice of Government the following discrepancies which exist in Dr. Macpherson's first and second reports on the cinchona plants, and which, I would respectfully point out, invalidate the whole of his remarks, and render his information of no value.

2. In letter No. 1, Dr. Macpherson ascribes the failure and death of the plants to a "want of elevation," only 3 to 4,000 feet, and in letter No. 8, Dr. Macpherson recommends a site in Coorg as admirable, though the elevation is only from 3 to 4,000 feet. Again, in paragraph 13 of No. 1 letter, Dr. Macpherson admits that "those planted under 5,000 feet yield but little quinine," and in the face of this admission recommends Coorg and condemns the Dodabetta site.

3. In paragraph 12 of letter No. 1, Dr. Macpherson says, "the southern decline of hills is that most suitable for its growth," and in letter No. 2, paragraph 7, contradicts himself and says, "the northern is the best."

4. In paragraph 9, letter No. 1, it is stated that "five per cent. was obtained" (this was under peculiar circumstances) from stunted plants which had died through being planted on a substratum of volcanic tuff (lava) on an exposed situation. There is no evidence to show that the general yield of the Java cinchona is five per cent. of quinine.

5. In "Notes on the Culture of Cinchona," page 13, Dr. Junghuhn "considers that the elevation for the culture of the cinchona is to be found at 5 or 6,000 feet above the sea." At page 15, Howard, the greatest authority, says: "The higher and colder the place of growth was, the more value was attached to the bark." Again, page 15: "Those cinchonas which are rich in alkaloids, inhabit the peculiar cloudy region of the Andes, in which, during the rainy season, which continues for nine months in the year, a steady rain is only interrupted during the day by short gleams of sunshine, interchanging with clouds and mist; whilst in that part of the year which answers to our winter, cold nights, in which the temperature of the air descends to freezing-point, are followed by days in which the rays of the sun, piercing here and there through the thick clouds, raise the temperature to 77° Fahr., whilst the leaves are kept almost constantly bedewed by the continual mists. The mean temperature of this region is about 55° Fahr." Dodabetta itself is 52° Fahr.; the mean temperature of the Dodabetta site is about 55° Fahr.; that of Coorg may be reckoned about 75° Fahr. Again, page 17: "The bark of those trees which grew in this ravine, far above

the normal limits of the forest-growing cinchona, gave $3\frac{1}{2}$ per cent. of sulphate of quinine, whilst the bark obtained from the cinchona of the lower-lying forest scarcely afforded one per cent."

6. From the above, it is clear that Dodabetta is the best site, and Coorg the worst, for producing quinine. The lowest height in Java (see page 6 "*Cinchona cultivation*") for plantations is 4,700 feet, not 3,000, as stated by Dr. Macpherson in paragraph 4, letter No. 2; the highest about 7,500, just the height of the Dodabetta site; mean temperature 57° . In paragraph 7 of Mr. Markham's letter to Government of 22d October 1860, he approves of the Dodabetta site. *C. nitida*, plants of which are now growing in the glass-house of the gardens, "grow on high mountains in cold situations" (*vide* page 21). It is true that *C. succirubra* is said to grow at an elevation of only 3,000 feet (Mr. Spruce's report); but this elevation is not to be relied upon, as neither aneroid nor mountain barometer was in the possession of Mr. Spruce, and the probability is (supposing it to be a good quinine-yielding plant) that the elevation was not under 6,000 feet, as the locality ranges over 12,000 feet of elevation.

7. Dr. Macpherson states that the Dodabetta site consists of granite and trap-rock. I can see none. The rock is gneiss, the substratum is decomposed felspar and hornblend—the former yielding 11 per cent. of potash, a most valuable ingredient for forming alkali; the latter supplies 13 per cent. of lime. Had we only trap and granite, the situation would be very indifferent. The surface mould is in many places two feet deep. The trees, in a clump which I measured, consisting of seven, averaged two feet in diameter and three feet from the ground, quite large enough for our purpose. Again, the Neddiwuttum site is spoken of in paragraph 9, letter No. 2, as "a stratum of yellow or reddish marl." Now marl is a compound of clay and lime, of which we have none on these hills. Mr. Spruce is probably mistaken also about marl, what is more probable, is a compound of mica and felspar, the greasy feeling being due to the mica: nothing could be better than this for a substratum, as mica gives for the formation of alkali 9 to 14 per cent. of potash, and felspar 13 per cent. There can be found a hundred suitable sites on these hills, with a substratum of the above.

8. In paragraph 11, letter No. 1, Dr. Macpherson speaks of raising seed under "narrow ridge roofed nurseries" (thatched?) "open on both sides." The only seed I know of that is grown in this manner is mushroom-spawn. I am confident that if this plan is to be carried out, not a seed will germinate at Neddiwuttum. In my former letter, No. 343, dated 28th January 1861, I recommended that the seed should be made over to Mr. McIvor, to be raised under glass, and I now again would most respectfully urge upon Government the absolute necessity of raising the seed under glass at present. A small quantity of seed has been distributed to different parties, in various situations, for trial, and if they are successful, more can be sent.

9. With glass we can command any temperature between 60° and 90° , quite sufficient for raising seed. If the seeds expected by Mr. Cross are now planted in the nurseries at Neddiwuttum, recommended by Dr. Macpherson, the monsoon will commence before they can germinate (those in the glass-house at Ootacamund having taken more than 60 days), and they must mildew and rot. The same will happen to the plants if planted out before they have made strong roots.

10. In paragraph 13, letter No. 2, Dr. Macpherson speaks of "chemical research" as having achieved success for the Dutch. I would remark that a good practical gardener would have done more for them, and further that, as far as quinine-yielding plants go, they have yet to attain success.

11. In paragraph 14, letter No. 2, an intelligent botanist possessing a knowledge of "analytical chemistry" is recommended. Mr. Howard, the great manufacturer, will soon settle the value of the bark; a better chemist we could not have.

12. In conclusion, I would observe that the Dutch have by no means accomplished success: they have grown some 90,000 plants (in the large glass house at Ootacamund we can store away 80,000 plants until fit for planting out), but they have yet to prove that those contain quinine. Had Dr. Macpherson given the market quotation of the bark, or an analysis by an English chemist,
instead

instead of the results of a partial experiment of an enthusiastic Dutchman, we might have had some proofs of success. It is notorious that neither the Java tea or coffee is considered good, whereas our Kangra tea surpasses the Chinese, and our Neilgherry coffee equals Mocha. With the exception of the expedient for raising seed, which every practical man versed in arboriculture must condemn, Dr. Macpherson has told us nothing but what we knew before, (*vide* "Notes on the Culture of the Cinchona," *passim*, by Mr. Markham, 1859); and the result of Dr. Macpherson's visit to Java has been, to recommend here what he condemned in Java, and paralyse our efforts by introducing an impracticable plan for raising plants from seed. Fresh seeds, according to Mr. Spruce, take from 4 to 25 days to germinate; old seeds, according to Mr. McIvor, from 60 to 90 days under glass. What time they will take in Dr. Macpherson's nurseries, supposing they ever germinate, it is impossible to say. The sandal-wood tree, if grown in a moist and shady situation, does not yield the same scent as that grown on partially exposed situations. Tea, if grown in a low latitude and elevation, commands no price in the market, and the like reasoning holds good with the cinchona; the higher the situation, the greater the production of alkaloid.

— No. 66. —

FROM MR. W. G. McIvor, Superintendent Government Gardens, Ootacamund, to J. D. Bourdillon, Esq., Secretary to Government, Madras; dated Ootacamund, 30 March 1861.

Sir,

1. I HAVE the honour to solicit the favour of your having the goodness to submit, for the consideration of the Right Honourable the Governor in Council, the following remarks on the subject of Dr. Macpherson's report, dated the 5th February 1861:—

2. I am induced to bring the circumstances under which this report was written to the notice of Government, being convinced, by practical experience and personal knowledge, that the order of Government under date 9th March 1861, if carried out, will render almost certain the entire failure of the important experiment now in progress for the introduction of the quinine-yielding cinchonas into India.

3. In my first interview with Dr. Macpherson, and while about to enter into botanical and horticultural subjects, he informed me that he was "entirely ignorant of botany and gardening;" that he had been selected by Government to inspect and report on the sites, simply because he had seen the cinchona plantations in Java, and the practice of the Dutch in "successful operation." He informed me that, as he had been sent here, he wished to give a good report to Government on the "whole subject," requesting my assistance in information. This I most readily gave, placing in his hands notes of all that has been published in English on the subject; also the valuable work of Dr. Weddell in French, together with the manuscript notes of Mr. Markham, at the same time pointing out and explaining the parts bearing on the subject in connexion with my experience of this climate.

4. Dr. Macpherson, in his report, lays much of this information before Government as the result of his own investigation and personal knowledge; and I would have been glad to have passed over in silence Dr. Macpherson's adoption of this rather unusual course, had it produced no bad results. But when his report has produced an order endangering the experiment, I feel myself called upon, by duty to your Honourable Government, to myself, and to the country, to detail with plainness and candour the facts which have led Government to place (as I will presently show) unmerited confidence in the opinions of Dr. Macpherson.

5. In paragraph 3 of his report, Dr. Macpherson gives altogether an incorrect description of the "Dodabetta site." Firstly, it is not "a scantily wooded shola," but on the contrary is composed of trees of the ordinary size and height pre-

vailing in the best forest or "sholas" on these hills, as the Conservator of Forests can testify, having at my request taken the measure of a clump of trees near the centre of the site. Secondly, it has not an "eastern aspect," but nearly a contrary one, the aspect being north-west. Thirdly, the soil is not "generally a superficial superstratum," as proved by specimens* from 1 to 10, taken from various parts of the forest. Fourthly, the soil does not rest on disintegrated granite—*vide* specimens from 11 to 15, both included. Fifthly, no "masses of trap" are found in any part of the site. Sixthly, it is not deficient in moisture, as can be proved by the register of the last 20 years kept in the Government Observatory at Dodabetta, and established by the specimens of the branches and bark, Nos. 16 to 18. Dr. Macpherson has omitted to give in his report the observations he made with the thermometer on this site, which I supply.†

6. In paragraph 4 of the report under review, Dr. Macpherson states: "Now, with these facts before us, it must, I think, be admitted that we are risking our seeds and plants by attempting to propagate them in the Government Gardens at Ootacamund, the elevations being 7,478 and 7,596 feet above the level of the sea." Such assertions as the above are very objectionable, because they convey the impression that Dr. Macpherson had given facts to prove that plants could not be propagated, or seeds raised, at such elevations; whereas Dr. Macpherson did not quote (nor can he quote) a single fact to prove his position, but simply his own opinion, founded as it is on a total want of knowledge of the subject. But I, on the contrary, have much pleasure in being able to state, for the information of Government, the very gratifying fact that many fine seedlings of three varieties of the cinchona are now growing, and have been reared, in the very places Dr. Macpherson condemns; and I state, without fear of contradiction, that no such favourable place can be found in India for rearing the cinchonas as the gardens under my charge.

7. In paragraph 5 of Dr. Macpherson's report, he urges your Government "without loss of time to adopt the system now so successfully working in Java." In paragraph 8 of his report of the 19th December 1860, we are informed of the extent of this success in Java, and that with the Dutch, "only one seed out of one thousand germinated." We have already raised over 3 per cent. of our imported seeds, and more are daily coming up, so that at the lowest estimate I have in this respect obtained 30 times the results of the Dutch; and I trust this important fact will induce the Government to reconsider paragraph 5 of their order of the 9th instant, No. 552, and more especially as the operation of this part of the order deprives the experiment of the advantage of the efficient appliances possessed by the garden for rearing seeds and propagating plants, and thus places Mr. Markham in a wrong position, with reference to his unwearied exertions for its success. On this part of the subject I would most respectfully remark that Dr. Macpherson, apparently

alarmed

* SPECIMENS OF SOILS FROM DODABETTA SITE.

No. 1,	from first ridge, six inches below the surface.
" 2,	from second ridge, do. do.
" 3,	from first valley, do. do.
" 4,	from third ridge, do. do.
" 5,	from second valley, do. do.

SPECIMENS OF ROCKS.

No. 11,	from first ridge.
" 12,	from second do.
" 13,	from first valley.
" 14,	from third ridge.
" 15,	from second valley.

SPECIMENS OF SUBSOIL.

No. 6,	from first ridge, six feet below the surface.
" 7,	from second ridge, do. do.
" 8,	from first valley, do. do.
" 9,	from third ridge, nine feet below do.
" 10,	from second valley, do. do.

SPECIMENS OF BRANCHES AND BARK.

No. 16,	from centre of site.
" 17,	upper limit.
" 18,	lower limit.

Forwarded by Banghy.

† Temperature of air from 12th December to 11th January, the coldest season in the year—

Mean	- - - - -	59½ degrees.
Lowest	- - - - -	54 "
Highest	- - - - -	67 "

Temperature of earth 63 degrees, at 18 inches below the surface.

Temperature of water in the stream under dense shade at 6 a.m., 52½ degrees; at 6 p.m., 54 degrees; in the water there was no variation throughout the month.

alarmed at the effects likely to be produced on the experiment, so far counter-orders this order of Government, that in paragraph 6 of the notes drawn up for my guidance, he directs that I will use my discretion in retaining a portion of the seeds and plants at the garden. The Conservator of Forests, in his letter No. 409 of the 21st, directs that I will put a "stop to any further attempt to propagate seeds or rear plants in the garden;" the order of Government being plain to this effect, I am at a loss how to proceed.

8. In paragraph 8 of Dr. Macpherson's report, he approves of the northern exposure of the sites I have selected; but he does not explain to Government the fact, that on his first inspection he entirely condemned the sites because of this exposure, distinctly informing me that "nothing but a southern exposure would suit the cinchonas, and this they had proved by long experience in Java:" all my arguments were used in vain to persuade Dr. Macpherson of the altered conditions of the climate which required altered circumstances. I named coffee estates which had failed and been parched up on south exposures, mentioned the greater capability of the coffee plant to endure drought and extremes of climates; and as it had failed, how could we expect to be successful with the cinchonas? Although these questions were unanswerable, they would have proved quite unavailing had it not been for the fortunate circumstance that while inspecting the Avalanche site we came on a narrow ridge, where I was enabled to show Dr. Macpherson at a glance the wonderful difference in the vegetation, caused by exposure only, between the two forests which lay at our feet (one facing the north, and the other the south): this accident brought conviction to his mind, otherwise Dr. Macpherson would have recommended your Government to have changed every site to the south, and thus brought the most certain destruction on the undertaking.

9. I pass over paragraphs 7, 8, and 9, not because they are free from error of description, but because they do not contain anything seriously calculated to mislead the Government.

10. While describing the soil of Neddiwuttum site in paragraph 10, Dr. Macpherson states that "the character of the soil generally on the surface is a rich black vegetable mould, 18 inches in depth, beneath which is a fine, red, coffee-coloured, friable, porous marl." Marl, in any shape whatever, has not been found on the Neilgherries, and certainly none on the Neddiwuttum site.

11. In Dr. Macpherson's letter to Government, dated Mercara, 20th February 1861, No. 8, a site on the Mangalore Ghât is strongly recommended for a cinchona plantation, the average of the "ridges" being given as "3,400 feet above the level of the sea." Prior to leaving the Neilgherries, Dr. Macpherson asked for and received my opinion on this site; he mentioned that he had seen Mr. Markham at Mysore, and recommended that gentleman to visit it. I pointed out to Dr. Macpherson that it is given as a rule, by every authority on the subject, that cinchona trees growing below 5,000 feet are deficient in quinine, although it is true that the largest cinchona trees are found at much lower elevations, even down to 1,000 feet, but, in the words of Dr. Lindley, many of these species "yield as little quinine as a willow." The object of this experiment is to produce quinine, and I submit the Government should call for further information before expending a large sum of money on the plantations on the Mangalore Ghât. Without any disrespect to Dr. Macpherson, I will quote him self as an authority against the measure he now recommends Government to adopt. In his letter to Government, dated Madras, 19th December 1860,* No. 50,

* Dr. Macpherson to Government, Madras, 19th December 1860, No. 50.

Paragraph 8.—Nurseries succeed best at, or under, 4,000 feet, the *Cinchona calisaya* grows only between 5,000 and 5,800 feet, the other species will flourish at a greater elevation. Those planted under 5,000 feet yield little quinine.

Dr. Junghuhn in his report, dated 1st July 1858, gives the elevation of the lowest plantation in Java at 4,704 English feet, the highest at 7,875 feet, and the plantation on the Gedog-Badah, as from 6,852 to 7,000 English feet above the level of the sea.

Humboldt gives the elevation—

For Quilled bark at	-	-	-	-	-	-	9,000 feet.
" Grey bark at	-	-	-	-	-	-	6,500 "
" Yellow or Calisaya bark at	-	-	-	-	-	-	6,200 "
" Red bark	-	-	-	-	-	-	4,500 "

No. 50, and at paragraph 8, Dr. Macpherson states that he (Hasskarl) "selected for his plantation the slope of the Geday mountain, about 100 miles from Batavia, varying in elevation from 3,500 to 4,500 feet above the level of the sea," remarking that, "ignorant of the habitudes of the plant, three mistakes were committed:" first, the elevation was insufficient—namely, the elevation of 3,500 and 4,500 feet he states to be insufficient, although 100 and 1,600 feet higher than the highest ridges of the site recommended in Coorg. When on the subject of elevation I give at the foot the opinions of the best authorities, by which it will be seen that we have much to learn on this point; and the safest way to attain this knowledge is by careful though inexpensive experiments, which the Neilgherries offer greater facilities for conducting than any other part of India. In conducting these experiments, it should always be borne in mind that the highest point at which the plant will flourish, and the greatest exposure it will bear without injury, is the most favourable for the production of quinine, because vegetable alkaloids (such as quinine) are not drawn from the earth, but are formed by the action of the leaves when exposed to light and air, and the power of this action is increased by elevation and a rarefied atmosphere.

12. I shall now proceed to notice the practice of the Dutch in Java, not from a wish to criticise their mode of operations, but because I am directed "carefully to carry out their practice." Long experience, in many instances dearly bought, has taught me the difficulty of carrying out a practice, however perfect and successful in other localities or countries, because of the great difficulty of faithfully applying the details of the practice to the varied local circumstances. But when a practice opposed to every principle of horticulture and vegetable physiology is attempted to be carried out, certain failure must of necessity follow.

13. The description given by Dr. Macpherson of what he saw in Java must convey to the mind of every man acquainted with horticulture a painful picture of the want of knowledge of the Dutch in these matters. But in justice to the gentleman in charge of the plantations in Java, I mention that many important discrepancies occur between their published accounts and that given by Dr. Macpherson, the instance given in the foot* being selected, as Dr. Macpherson grounds on it the whole change of the culture in Java; but as my object is simply to deal with this matter in so far as the accounts have misled Government, I shall only notice the operation as described by Dr. Macpherson.

14. In paragraph 14 of Dr. Macpherson's letter of the 19th December 1860, No. 50, it is stated, "chemical researches have shown a considerably larger amount of quinine in the plants grown in the Island of Java than in any yet imported

Howard, Karsten, and Poeppig give nearly the same elevation for all the varieties of bark except the red bark.

Markham gives the best elevation for grey and crown barks at from 6,300 to 7,000 feet.

For Calisaya bark - - - - - 5,000 feet.

Spruce for red bark - - - - - 3,000 "

Weddell for the *C. ovata* (which Howard says is the red bark) gives an elevation of 5,900 to 7,500 feet.

NOTE.—The probable cause of these discrepancies may be found in the fact, that in the neighbourhood of high mountains, the temperature of the valleys are much reduced at night, because the cold air generated on the mountain tops, being of greater specific gravity, descends rapidly, displacing the warm air of the valleys. Consequently, the region of the different species of cinchona will be lowest where the mountains are high, and their tops covered with snow, and highest where the mountains are comparatively low. W. G. McIvor.

* Dr. Macpherson, to Government, Madras, 19th December 1860, No. 50, paragraph 8 *** "2d. The ground should not have been cleared, for the fungi generated by the decaying roots of the forest trees proved pestilential to the growth of the cinchona tree, as is shown in the specimen of the root herewith sent of one that struggled on for six years."

In Mr. Clements Markham's translation of Dr. Junghuhn's report, at paragraphs 3 and 4, a very different account of the cause of fungi is given: "The attacks of the *Rhizanthus*, which are also met with at Tjiniruan; but the plants here have been rendered more liable to them, by the great wooden stakes that Hasskarl had driven in, to protect the young plants from the stormy winds, so close as to injure their roots; and as the ends of the stakes decayed in the earth, they were attacked by fungi.

The strong south-west winds, which prevail during the rainy season, they blow with such force, that several cinchona trees have been half cut through by the strong cords by which Hasskarl, without the production of soft moss, had caused them to be tied to the stakes.

imported from South America," * * * "three per cent. appears the largest average in the latter, whereas five per cent. was discovered in the former." That this result is most encouraging is a fact beyond all dispute; it is probable also, because in cultivation plants can be placed in more favourable conditions for the production of certain secretions than usually happens in nature. Dr. Macpherson does not state it, but it is certain that this gratifying result must have been obtained from the plants exposed to light and air, *i. e.* grown on the site effectually cleared of forest, as it is as impossible for a cinchona plant to produce quinine when grown in dense shade, as for an animal to be fed without food. Dr. Macpherson details the system now followed in Java—namely, that of planting the trees under dense shade without even clearing away the underwood—as a complete success: experience will prove the reverse, and will one day establish the fact that, having gone from one extreme to the other, the Dutch are retrograding instead of progressing in the culture of the cinchona for the production of quinine, and that they are now, figuratively and literally, working in the dark. I append the opinion of Dr. Lindley* on this subject, and this can be supported by hundreds of authorities, and the fact of everyday experience with all plants, as no plant can thoroughly elaborate its juices or perfect its secretions in dense shade.

15. I would further remark that our experiment, so far as it has gone, will bear favourable comparison with that of the Dutch. Dr. Hasskarl's expedition to South America cost the Government, I am informed, 10,000 *l.*, and occupied upwards of two years, and was productive of less results than the expedition of Mr. Markham has already been, if nothing more comes from it than the plants now growing in the gardens. On this subject I would remark, that I learn from Mr. Anderson that he brought plants of the *Cinchona Calisaya* to Ceylon; I also received from that gentleman seeds of the species noted at the foot.† More of these and other species may shortly be expected from Kew, and more are daily coming up here, so that at the lowest estimate I may safely say, that one-tenth of the results to be fairly expected from Mr. Markham's expedition have not yet developed themselves. The two cuttings (one of *Cinchona Calisaya* and one of *C. ovata*), are still alive, but show no signs of growth.

16. Appended is a detailed report of the seeds reared here, the time they have taken to germinate, and the various modes of treatment adopted.

17. With reference to planting seeds on the plan adopted in Java, namely, that of sowing them in beds, "one seed in a pot or bamboo" under thatched sheds, and watering them "twice daily from the squeeze of a sponge," is so absurd that I am confident, on reconsideration, your Honourable Government will not require such a mode to be put into practice: few persons have any idea of the care and attention required to rear these small and delicate seeds, especially after a long journey and exposure to many vicissitudes of climate.

18. With reference to selecting the "Dodabetta site," now condemned by Dr. Macpherson, and the work stopped for the present by Government, I have
the

* Lindley's Theory and Practice of Horticulture, page 70.—"It is to the action of leaves; to the decomposition of their carbonic acid, and of their water; to the separation of the aqueous particles of the sap from the solid parts that were dissolved in it; to the deposition thus effected of various earthy and other substances, either introduced into plants, as Silica and metallic salts, or formed there, as the vegetable alkaloids; to the extrication of nitrogen and, probably, to other causes as yet unknown—that the formation of the peculiar secretions of plants, of whatever kind, is owing; and this is brought about principally, if not exclusively, by the agency of light. Their green colour becomes intense, in proportion to their exposure to light within certain limits, and feeble in proportion to their removal from it, till, in total and continued darkness, they are entirely destitute of green secretion and become blanched or etiolated. The same result attends all their other secretions: timber, gum, sugar, acids, starch, oil, raisins, odours, flavours, and all the numberless narcotic, acrid, aromatic, pungent, astringent, and other principles derived from the vegetable kingdom, are equally influenced, as to quantity and quality, by the amount of light to which the plants producing them have been exposed."

† Mr. Anderson to Mr. McIvor, Calcutta, 8th March 1861.—"I also brought out three plants of the *Cinchona Calisaya*, which I sent up to Peradenia in charge of Mr. Thwaites, head-gardener; one was a large plant three feet high. It arrived in excellent order."

Cinchona micrantha provinciana.

C. micrantha Pata de Gallinazo.

C. succirubra.

C. nitida.

C. Without name.

* Dated India Office, London, 9th June 1859, No. 21; also dated India Office, London, 17th August 1860, No. 42.

the honour to state that, in the first instance, the Secretary of State for India* requested information from Dr. Cleghorn and myself on the subject of the sites best suited for the cultivation of the cinchonas. Ill-health prevented Dr. Cleghorn from visiting the localities and selecting the sites. Prior to that gentleman leaving for home, he left this duty entirely to myself, stating, "it could not be left in better hands." At the time I felt myself insufficiently informed to accept so great a responsibility, and although I named the sites which appears suited, I recommended that they should not be finally adopted until we had the benefit of Mr. Markham's personal knowledge of the natural localities of the plants. That gentleman on his arrival here inspected this site, and on a careful comparison of what he observed on the Andes highly approved of it. Mr. Markham, being here for a short time only, had not an opportunity of observing the moisture of the climate. The observations made by Mr. Markham were forwarded to Mr. Howard, the best judge in Europe of such matters, and that gentleman's opinion is given in the foot-note.† Subsequent observations and inquiries confirm in my mind that this site is eminently suited for the experiment, and it is most unfortunate that the work should have been stopped at the very time the plants requiring a high elevation are growing in the gardens.

19. I most respectfully beg to solicit that your Honourable Government may be pleased to place this experiment on the Neilgherries entirely under my management, or release me from any connexion with it.

20. I make this request having been taught, in the early stages of the garden,‡ the utter impossibility of conducting operations, either to the satisfaction of Government or myself, when constantly interfered with by parties possessing no practical knowledge of the matters in which they would direct. I therefore trust that the success I have attained in these gardens may be taken into consideration, and that Government may repose the same confidence in me they have hitherto done. My long experience (13 years) on these hills, and consequently my possession of local knowledge in horticultural matters, which must prove of great advantage in conducting this experiment, is a subject worthy of the consideration of Government. I possess testimony to my attainments in botany, vegetable physiology, and horticulture from the most eminent men in Britain§; and not only do I possess this knowledge, but that I am qualified to apply it with judgment

† From Mr. Markham, 10th February 1861.—"I have heard from Mr. Howard, who thinks the site for a cinchona plantation in the shola behind the gardens well chosen if it be not too dry, that is, if it is moistened with sufficient showers."

"The conditions favourable for the production of quinine are evidently those of a continuous vegetation with a mean temperature of from 60° to 70°, varying a little according to the species."

(No. 126.)

Public Department.

‡ "Extract from the Minutes of Consultation, dated 9th February 1853," paragraph 8.—"In originally appointing a Committee (Extract Minutes of Consultation, 20th June 1848), the Government distinctly declared that interference with the gardener in professional matters should be avoided. It was difficult to state how far the control of the Committee should extend, but it was intended that it should be of a general character; that, in fact, they should merely see that the superintendent was carrying out the objects for which the garden was established, and not that he should be placed entirely under their orders and deprived of all power of acting without their instructions."

Paragraph 9.—"The progress which the gardens have since made renders it desirable that this control should be still more relaxed, and the Government think the most expedient plan now is to place the gardens and their establishment entirely under the management of Mr. McIvor, who has shown himself equal to the task, and who will have an additional stimulus to exertion by being made wholly responsible for its success or failure."

§ Sir W. J. Hooker, in "London Journal of Botany," June 1847.—"A separate work was still much needed upon the Hepaticæ, and we have now the pleasure to announce an excellent little volume on these, the labour of Mr. W. Graham McIvor, at this time attached to the Royal Gardens, Kew. While resident in Scotland, and since his sojourn in England, this botanist has been indefatigable in his researches after these beautiful plants, and has consequently been eminently successful, and no less so in the accurate determination of the species."

Professor Lindley bears similar testimony to my botanical attainments.—"Gardeners' Chronicle and Agricultural Gazette" for 1848, page 20.

From Mr. Westwood, Botanic Gardens, Dollar, 1st November 1845.—"I may with confidence recommend him to your notice, as one who is likely to employ the energies of an active mind to advantage in any department of his profession."

From.

ment and develop it with success, is established by numerous minutes by the Government of Madras; also the Secretary of State for India, and the late Court of Directors have honoured me with frequent and creditable mention of my "zeal, skill, and activity;"* from the Secretary to the Government of Madras, dated 12th January 1859, No. 3; from the Honourable Court of Directors to Madras Government, dated 5th August, 1857, No. 51, and others.

21. Should your Honourable Government think fit to place the cinchona plantations on the Neilgherries entirely in my hands, I will accept the responsibility of their success or failure. I do not promise to conduct the experiment throughout without mistakes, but I fear not to guarantee to Government greater results, and at far less cost, than they will obtain in Coorg or elsewhere.

From Mr. J. McNab, Royal Botanic Gardens, Edinburgh, 8th December 1847.—"I would consider you eminently qualified for any situation, either horticultural, botanical, or combined, that may occur at home or abroad."

From Mr. Cuthbertson, Yorkshire, 8th December 1847.—"He has a thorough knowledge of gardening in all its branches; in short, he is a most enterprising young man, and it is very rare to find a young man to equal him."

From Mr. J. Smith, Curator, Royal Botanic Gardens, Kew, 11th December 1847.—"Therefore, viewing his general good conduct, his practical knowledge of gardening, and his botanical knowledge, I have no hesitation in considering him a most efficient person to fill the gardener's situation now vacant in India."

"Minute by the Honourable the President.

* "I have visited the garden, and entirely agree with Dr. Cleghorn that Mr. McIvor deserves great credit for the manner in which he has laid it out. The garden is both a beautiful pleasure-ground and a valuable public institution for the improvement of indigenous and the naturalization of foreign plants; and it has been formed from the commencement by Mr. McIvor, with great industry and artistic skill, out of a rude ravine.

"The advantage of Mr. McIvor's science and experience will be in a great degree lost, if means are not taken to train up under him persons who can profit by his teaching, and if he is not relieved from mere clerical work.

"Ootacamund, 24th February 1861.

(signed) "C. E. Trevelyan."

"Extract from the Minutes of Consultation, under date the 15th March 1859 (No. 323).

"The Governor in Council has much pleasure in giving effect to this order of the Home authorities, being of opinion that Mr. McIvor has fully earned this augmentation of salary by his zealous and intelligent discharge of his duties; and he desires to express his sense of the great improvement which Mr. McIvor's care, and skill, and judgment have effected in the garden."

Revenue Department.

Proceedings of Madras Government, 15th May 1860 (No. 781).

Paragraph 5.—"They concur with Dr. Cleghorn that the Superintendent deserves great credit for his important application of moss, whereby, at once, young plants intended for transplanting are better prepared than formerly for removal, and can be transported at less than one-tenth of the usual cost, while the garden space is also economized.

(signed) "J. D. Bourdillon,
"Secretary to Government."

REPORT showing the NUMBER of CINCHONA SEEDS reared at the Government Gardens, Ootacamund, with a detailed Account of the various Modes of Treatment.

Names of Species.	Nature of the Soil in which sown.	Amount of Shade.	Amount of Water.	Preparation of Seeds before sowing.	Number of Days before Germination took place.	REMARKS.		
						Number which Germinated strongly.	Number which Germinated weakly.	Total Number of Seedlings.
No. 1. <i>Cinchona micrantha</i> , variation Provinciana.	A mixture of three equal parts— one of burned earth, one of sand, and one of very old cow-dung.	Shaded in bright sunshine only.	Watered sparingly at first, and only when the soil was dry on the surface.	Steeped for four hours in oxalic acid.	62	61	16	77
No. 2. Ditto - - ditto	Ditto - - ditto - -	Ditto - - ditto	Watered morning and evening.	12 hours in lime	-	None	None	None
No. 3. Ditto - - ditto	In brown loam selected by Dr. Macpherson.	Shaded throughout, except in the mornings and evenings.	Ditto - - ditto	Steeped four hours in oxalic acid.	64	None	1	1
No. 4. Ditto - - ditto	In black loam selected by Dr. Macpherson.	Ditto - - ditto	Ditto - - ditto	None - - -	-	None	None	-
No. 5. Ditto - - ditto	A mixture of equal parts of loam, burned earth, and leaf-mould.	Shaded in bright sunshine only.	Watered as No. 1	None - - -	65	None	8	8
<i>Cinchona micrantha</i> , var. <i>Pata de Galimazo</i> .	Soil prepared as at No. 1 - -	Ditto - - ditto	Ditto - - ditto	Steeped as No. 1 -	63	18	6	24
Ditto - - ditto	Soil as No. 1 - - -	Ditto - - ditto	Ditto - - ditto	None - - -	-	None	None	-
<i>Cinchona nitida</i>	Soil prepared as at No. 1 - -	Ditto - - ditto	Ditto - - ditto	Steeped four hours in oxalic acid.	66	46	14	60
Ditto - - ditto	Prepared as at No. 4 - -	Ditto - - ditto	Ditto - - ditto	None - - -	68	None	2	2
TOTAL Number of Seedlings						125	47	172

In the treatment of these seeds, they appeared to be impatient of too much shade and moisture, soon becoming mouldy and rotting off. The seeds were sown on the surface, and covered with a thin coating of finely cut moss. The black and brown loams, as used in Java, seemed to retain too much water, and are certainly unsuited for rearing old seeds. Fresh-gathered seeds, possessing great vital power, may grow in loam, but not so freely as they would in soil prepared as at No. 1. The seeds are easily distinguished when they begin to germinate, as they strike their radicles into the ground with great force, considering the small size of the seed; the radicle being established in the ground, the plumule is raised up with the seed on the top of it, where it remains three or four days; then it falls off, and the seed-lobes (*Cotyledons*) expand. I give this description of the process of germination, as I find it is not described in any of the works I possess.

(signed) W. G. McIntosh,
Superintendent, Government Gardens.

Enclosure 1, in No. 66.

FROM *D. Macpherson*, Esq., M.D., Inspector General of Hospitals, to *J. D. Sim*, Esq., Secretary to Government, Revenue Department, Fort Saint George; dated (on the tour of inspection) Rangoon, 24 July 1861.

Sir,

1. CONSEQUENT on the nature of my duties within these provinces during the past four months, copies of Captain Morgan's and Mr. McIvor's letters, and the Government order thereon, bearing on my report to you, dated 5th February, No. 7, only reached me a few days since.

2. With regard to his (Captain Morgan's) remarks and criticisms on my public reports to Government in matters relating to the introduction of cinchona into India, I feel it incumbent on me to reply as follows:—

3. In the first paragraph of his letter, dated 28th of March last, No. 418, Captain Morgan asserts "that the existence of certain discrepancies between my first and second reports invalidates the whole of my remarks, and render my information of no value." On this he proceeds to show—

The first "discrepancy," which relates to the subject of "elevation" for the growth of cinchona trees, asserting that in my letter No. 1, I condemn what I recommend in letter No. 8. Had Captain Morgan quoted correctly, he should have said that in the former I stated nothing from my own knowledge. I merely reported the result of experiments made in Java, specially observing, in the same paragraph from which he quotes, "but the best elevations have yet to be ascertained." In the latter I gave my opinion, as directed, on what appeared to me to be the best plan to pursue in our experiments; an opinion, as far as relates to the Dodabett and Coorg sites, I still maintain to be correct.

The second instance of "discrepancy" relates to the "southern decline" of the hill being recommended in my Java report, whereas in my Neilgherry letter I state "that the northern is the best." Captain Morgan is correct; and I am indebted to Mr. McIvor's superior knowledge in horticulture, as graphically described in paragraph 8 of his letter, for "bringing conviction to my mind by his unanswerable arguments."

4. Paragraphs 4, 5, and 6 of Captain Morgan's letter call for no observations.

5. Captain Morgan states, in paragraph 7 of his letter, that I incorrectly describe the Dodabett site, as consisting of "disintegrated granite, or masses of trap protruding on the surface." The "rock," he says, "is gneiss, the superstratum is decomposed felspar and hornblende, the former yielding 11 per cent. of potash, a most valuable ingredient for forming alkali" (what is potash but an alkali?) "and the latter supplies 13 per cent. of lime." Now, as gneiss "is a slaty or secondary granite, as when granite passes by several perceptible gradations into gneiss" (*vide* Humble's Dictionary of Geology), and as "trappean rocks are composed of two minerals, felspar and hornblende" (*vide* Lyall's Geology, page 463), Captain Morgan's assertion is only opposed to mine in terms dissimilar, but of corresponding signification. Such being the case, in Captain Morgan's own words, the Dodabett site "is a very indifferent situation."

6. Captain Morgan, in observing on the word "marl," used by me in my Neilgherry letter, says, "Now marl is a compound of clay and lime, of which we have none on these hills." He forgets that in four lines above this remark he alludes to the presence of 13 per cent. of lime in the composition of the substratum on the Dodabett site. Lyell, at page 13, states that the "word marl is used ambiguously, and is applied to substances in which there is no lime, as to the red loam, usually called red marl in certain parts of England. Agriculturists are in the habit of calling any soil marl which falls to pieces readily on exposure to the air." It was in its agricultural signification that I applied the term, the construction alone which a practical gardener like Mr. Weir or Mr. Spruce employed it.

7. Captain Morgan discovers other "discrepancies" in my statements, which are as easily demolished as the above have been. But I have more important duty on hand than to waste time in confuting assertions by one who criticises my official acts in the style which pervades his letter; nor indeed would I have taken the trouble to do what I have done, had it not been for the endorsement on the Government order of the 16th April 1861, No. 855, which induces me to solicit that the same publicity which was given to the documents under reply may also be accorded to this.

Enclosure 2, in No. 66.

ORDER of the Madras Government, 16 April 1861.

1. THE papers above recorded relate to the prosecution of the attempts to introduce the cinchona tree into South India. It is unnecessary to review them at length; and the Government will merely notice those points on which orders are required.

2. It was directed in the order of the 9th March, No. 552, that the site at the back of the Government Garden at Ootacamund should be abandoned, and also that a stop should

be put to attempts to raise cinchona plants and seeds at the garden. In deference to the opinion expressed by Mr. Markham, as well as by Mr. McIvor, the Government now modify that order, and give permission to continue the operations at the garden ravine site, as well as to retain at the garden for the present the plants brought by Mr. Cross, and sow the seeds, as the Neddiwattum site is not ready, and does not contain the necessary appliances.

3. The Governor in Council, however, desires that this last-mentioned site, which Mr. Markham considers (paragraph 19) to be eminently well suited to the purpose, shall be prepared as soon as possible, and a portion of the plants transferred to it. The Government had hoped to engage the services of Mr. Cross to have immediate charge of this plantation; but from Captain Morgan's letter of the 9th April, they learn that he is unwilling to remain in India. The Government have applied to the Secretary of State to send out Mr. Weir, and they will repeat the request, now it is found that Mr. Cross does not desire to remain.

4. For the present the Government plantations will be confined to these two sites; but seeds should be distributed to those coffee planters in Wainâd and Coorg who may wish to try and rear them. After the result of the experiment on the Neilgherries shall be known, the Government will be prepared to commence operations at the site selected in Coorg, which Mr. Markham (paragraph 21) agrees with Dr. Macpherson in regarding as well suited to a cinchona plantation.

5. In accordance with Mr. Markham's recommendation (paragraph 33), the operations at both the sites now fixed on, viz. the garden ravine and Neddiwattum, will be entrusted to Mr. McIvor. Captain Morgan will report, after consulting with him, as to the arrangements to be made for the immediate superintendence of the operations at Neddiwattum, until the arrival of Mr. Weir or some other qualified gardener from England.

(True extract)

(signed) *J. D. Bourdillon,*
Secretary to Government.

To the Conservator of Forests.

„ Board of Revenue.

„ Inspector General of Hospitals.

„ Superintendent Government Gardens, Ootacamund.

— No. 67. —

From the Government of Madras to Sir *Charles Wood*, dated Madras,
24 April 1861.

Proceedings of
Government, 16th
April 1861,
Nos. 265 to 271.

WE have the honour to forward for your information the papers specified in the margin, relating to the introduction of the cinchona tree into South India.

2. Mr. Cross arrived at Ootacamund on the 9th April, with 463 plants of the *C. succirubra* and six *Calisaya* plants, all in good order. As many as 172 plants had also been raised from seed in the Ootacamund Gardens up to the 30th March.

3. You will observe that Mr. McIvor, of the Ootacamund Government Garden, a man of much intelligence and skill in his calling, disputes the justice of Dr. Macpherson's views as to the proper management of the seeds and plants, and that he is partly supported by Mr. Markham, in a despatch* written from Bombay to the Under Secretary of State for India, of which a copy was sent to us. In deference to the opinions thus expressed, we have modified our order of the 8th March, No. 552, and permitted Mr. McIvor to continue the operations at the garden ravine site, and also to have a nursery for cinchonas in the garden.

4. We were desirous to engage Mr. Cross, recently arrived in charge of plants, to have charge of the Neddiwattum plantation; but he is unwilling to remain in India. We beg, therefore, to repeat the request contained in paragraph 4 of our former Despatch, that Mr. Weir may be engaged and sent out, with as little delay as possible, to have charge of that plantation. Mr. Weir appears to be peculiarly well fitted for the charge; but if he should not be willing to come, then we beg that some other competent gardener may be sent out.

5. We

* Dated February
26th 1861, No. 8.

5. We have resolved that, for the present, the Government plantations shall be confined to these two sites; but we have directed that seeds shall be distributed to those coffee planters in Wainád and Coorg who may wish to try and rear them. After the results of the experiments on the Neilgherries shall be known, we shall be prepared to commence operations at the site selected in Coorg, which Mr. Markham (paragraph 21) agrees with Dr. Macpherson in regarding as well suited to a cinchona plantation.

6. In accordance with Mr. Markham's recommendation (paragraph 33), we have entrusted the operations at both the sites now fixed on, viz., the garden and ravine at Neddiwuttum, to Mr. McIvor. Captain Morgan, our Acting Conservator of Forests, has been directed to report, after consulting with him, as to the arrangements to be made for the immediate superintendence of the operations at Neddivattam, until the arrival of a qualified gardener from England.

7. It is desirable that a second gardener should be sent out from England, to have charge either of the Coorg plantation or of that at the Avalanche site on the Neilgherries, whichever may be formed first. We would request you to send out such a person without delay; because, until such new plantation shall be undertaken, he may be very usefully employed, under Mr. McIvor's instructions, in acquainting himself with the habits of the cinchona plant and its mode of treatment.

— No. 68. —

From *Clements Markham*, Esq., to the Under Secretary of State for India
in Council.

Sir,

Valetta, 8 April 1861.

I HAVE great pleasure in reporting, that I met the gardener, Cross, at Aden, on board the Peninsular and Oriental steamer "*Orissa*," on the 19th of March, with 15 cases of cinchona plants, in excellent condition, consisting of about 600 *C. succirubra*, and six *C. Calisaya*, from Kew—the latter not being in so hopeful a condition, but still alive. The Red Sea was very cool, the thermometer being at times as low as 65 degrees, so that the plants have not been exposed to any great heat, and their stems, leaves, branches, and roots were in the most perfect state possible.

2. Before I left Bombay, arrangements had been made for transmitting the plants to Calicut, in Her Majesty's steamer "*Pleiad*," without a day's delay, so that long ere this they ought to have arrived at Ootacamund and Ceylon.

3. Though, in the course of this experiment, more than one disappointment has been encountered, yet the present prospects of final success are encouraging, and a large measure has already been achieved. The species yielding red bark, the most valuable next to the *Calisaya*, has by this time been safely introduced, in large quantities, into India and Ceylon. Six plants of *C. Calisaya* have now reached Ootacamund, in addition to those of my collection, which still survive, and Sir William Hooker has been very successful in striking cuttings from a *C. Calisaya* at Kew; so that I trust another case may be transmitted to India, in the next cold season, of that inestimable species. The plants of the collection brought by Mr. Pritchett, which have already been transmitted to India, have failed; but his seeds have germinated freely at Ootacamund, as well as at Kew and in Jamaica, and young plants of these species may also be sent to India in the next cold season.

4. Thus, although, as was to be expected, several failures and disappointments have taken place in the course of an experiment of such great difficulty, and requiring, to ensure success, such a combination of favourable circumstances, as well as of various kinds of knowledge, energy, and forethought—yet, in consequence of the numerous precautions which have been taken, both by orga-

nizing three distinct expeditions and by establishing depôts to fall back upon both at Kew and in the West Indies, there is now a good prospect of establishing in the hills of Southern India, and in Ceylon, all the species of cinchona plants which yield alkaloids of medicinal value.

5. The knowledge acquired, by personal observation, of the native forests of the *C. Calisaya* by myself, and of those of the *C. succirubra* by the gardener Cross, will have been of great advantage in comparing them with analogous sites in the Indian hills, and in imparting such knowledge to Mr. McIvor; so that he will enter upon the superintendence of the cinchona plantations in India with a tolerably full acquaintance with the requirements of the plants, as regards climate, soil, and elevation.

6. I regret to say, that Cross declines to remain in India, and desires to return to England as soon as possible; so that it will be necessary to secure the services of some other gardener, to assist Mr. McIvor in the superintendence of the cinchona plantations. Such help, even if the experiment is to be conducted on the very smallest scale, is absolutely essential. The Dutch Government in Java, who are determined to spare no expense in ensuring the introduction of this invaluable plant, have organized a much larger staff, consisting of a superintendent, with a salary of 1,200*l.* a year, with no other duty, an agricultural chemist, and a numerous staff of gardeners and labourers.

7. I shall defer any further observations and suggestions respecting the service on which I have been employed, until my arrival in England; and trusting that the Secretary of State in Council will, on the whole, be satisfied with the way in which I have performed the duty the conduct of which has been entrusted to me,

I have, &c.
(signed) Clements R. Markham.

— No. 69. —

From Clements Markham, Esq., to the Under Secretary of State for India.

Sir,

Torquay, 30 May 1861.

I HAVE great pleasure in reporting, for the information of the Secretary of State for India in Council, that I have received a very favourable account of the state of the cinchona plants in the Neilgherry Hills, from Mr. McIvor, down to the 23d ultimo.

2. Of the six plants of *C. Calisaya*, he is certain of saving four, and perhaps five.

9. Of the seeds of *C. succirubra*, upwards of 100 have already come up, and Mr. McIvor makes certain of 70 to 80 per cent. of the remainder.

4. He already has a fine stock of strong young seedling plants of *C. nitida* and *C. micrantha*.

5. Of the plants of *C. succirubra*, 463 in number, which arrived at Ootacamund early in April, Mr. McIvor reports that he will save the whole.

7. With reference to my memorandum, dated 17th May 1861, I now find that, in consequence of the receipt of a copy of my report, dated Bombay, February 26th 1861, and of a letter from Mr. McIvor, the Madras Government have modified their order of 9th March 1861, No. 552, with regard to their concurrence in the recommendations of Dr. Macpherson; and in their order of 16th April 1861, No. 855, they direct that the operations at the Dodabetta site may be resumed, and that the propagation of seeds and raising of plants in the Government Gardens may be continued. Most fortunately, Mr. McIvor, feeling that the removal of the tender cinchona plants would ensure their destruction, had ventured to delay his obedience to the previous order of the Madras Government,

Government,

Government, and thus the only mischief which has been caused by Dr. Macpherson's interference, has been a delay of more than a month in the preparation of the important Dodabetta site.

7. The directions contained in the Despatch, which has lately been approved, have thus been anticipated by the Madras Government, who, in their order of 16th April, have entirely cancelled their previous order of 9th March; but these contradictory orders point out the great importance of placing the cinchona experiment in charge of one competent and responsible person, who would not be exposed to constant interference from officers who are entirely ignorant of the subject on which they offer opinions to the Government.

8. The proceedings of Dr. Macpherson are an example of the mischief which such interference may cause. In consequence of having visited the cinchona plantations in Java, and written a short account of what he saw, the Madras Government ordered him to proceed to the Neilgherry Hills, and report upon the sites selected by me for cinchona cultivation. Those sites were selected, and the other arrangements connected with the experiment were made, by me in communication with Mr. McIvor, after a careful and unremitted study of the subject for nearly two years, after a minute examination of the cinchona forests of South America, and after having made myself thoroughly acquainted with the proceedings of the Dutch in Java, through the published accounts of Dr. Junghuhn, the superintendent. Yet the recommendations of Dr. Macpherson, which, if carried into effect, would have ensured the destruction of the plants and involved the abandonment of one of the sites, were at once adopted by the Madras Government, without any reference either to myself, although specially sent to India by the Secretary of State to select these sites, or even to Mr. McIvor.

9. It is true that, more than a month afterwards, the Madras Government cancelled the order in which they had adopted the recommendations of Dr. Macpherson, but in the meanwhile the mischief might have been done; and hereafter the recommendations of any other officer equally ignorant of the subject might with equal reason be adopted, and retard the success, or even cause the entire failure, of this important experiment.

10. For these reasons I would venture to urge most strongly, that the whole charge of the experiment should be placed in the hands of Mr. McIvor, who is willing to undertake the responsibility. In his letter to the Madras Government, dated 30th March 1861, he requested that the matter might be placed entirely in his hands, or that he might be released from any connexion with it. This appears perfectly reasonable, for Mr. McIvor cannot be expected to undertake any responsibility, if he is to be exposed to constant interference from Dr. Macpherson. The whole management of the experiment, both as regards the measures to be adopted for clearing the sites and cultivating the plants, and as regards the engagement of labourers, should, I submit, be placed entirely under Mr. McIvor's management, and he should be responsible to, and in direct communication with, the Government.

11. The Madras Government has now ordered both the sites on the Neilgherry Hills to be prepared as soon as possible, and all the operations to be entrusted to Mr. McIvor; but his proceedings are to be reported through Captain Morgan, the Acting Conservator of Forests, instead of his being placed in direct communication with the Government. The plants, when planted out, will run many risks from elks and pigs, at first; and Mr. McIvor proposes to retain all the original plants in the Government Gardens, where no accident can befall them, and to propagate from them, planting out only those which have been propagated. The original stock would always be retained for the purpose of propagation, and by these means there would be many thousands of plants ready to plant out by next spring.

13. The superintendence of this important and very difficult experiment will entail much toil and expense, as well as anxiety; and the Secretary of State in Council will probably consider that Mr. McIvor should be allowed 300 rupees per month. The Dutch superintendent, I understand, is in the receipt of 1,200 *l.* a year, with the rank of a resident (equivalent to our collectors), or

nearly four times the sum ; although we have achieved twenty times the success of the Dutch, in half the time, and at half the cost. While the Dutch only have one valuable species, we have procured the best species of cinchonæ, yielding red, grey, and yellow barks ; while they only saved one plant, which was conveyed direct from South America, we have secured several hundreds ; while only one in a thousand of their seeds came up, from 70 to 80 per cent. of ours are germinating ; and while their single expedition to South America cost them 10,000 £., and lasted two years, our three expeditions will have cost under 5,000 £., and will have taken only one year. With far greater economy, we have attained a considerably larger measure of success ; the attempt is of greater importance to our vast Indian Empire than to the small island of Java ; and therefore, while the Dutch superintendent of cinchona plantations, for that duty alone, receives a salary of 1,200 £. a year, it does not appear that 360 £. will be too much for the gardener who undertakes the superintendence in the Neilgherry Hills. Special qualifications, not easily met with, are required for the post ; the duties will entail much toil, expense, and anxiety, and the responsibility will be great. A smaller allowance would, I think, be insufficient, and Mr. McIvor is ready to undertake the duties for 300 rupees per month.

14. It is gratifying to find that the gardener, Cross, who has personal knowledge of the forests where the *C. succirubra* grow, is of opinion that the site selected by me at Neddiwattum is peculiarly well adapted for the cultivation of that valuable species, and, indeed, that the plants will grow better there than in their native forests, the soil being superior.

15. Cross has refused to remain in India, and the Madras Government have requested that Weir, the man who accompanied me to South America, may be sent out to work under Mr. McIvor at the Neddiwattum site. Unfortunately, Weir has, I believe, already sailed for Brazil in the employment of the Horticultural Society, and it will therefore be necessary to engage the services of some other man. I have now to request that I may be authorized to search out and engage a gardener for this service, with a salary of 150 £. a year to begin with, increasing at the rate of 10 £. a year, but with the understanding that he shall not forsake the service of Government during a specified term of years. Unless some such understanding is come to, and a yearly increase of salary is allowed, it seems hopeless to suppose that a gardener of any attainments will remain in Government employ in India, when he is almost certain to be tempted by far more advantageous offers from private persons.

16. In a former letter, I suggested that I should be authorized to arrange with Mr. Spruce to procure a supply of seeds of the *C. Condaminea* for the sum of 100 £. In Mr. Spruce's letter, dated Guayaquil, 12th October 1860, he reports the obstacles which prevented him from procuring a supply during last season, but he has since offered to perform this service for the above sum. *C. Condaminea* (the tree growing in the Loxa forests, and yielding the crown bark of commerce) is the only very valuable species which is not yet introduced into India. It is the earliest known species, the *Cinchona officinalis* of Linnæus, the plant specially described by La Condamine, Humboldt, and Pavon, and is still of great commercial value. The sum required by Mr. Spruce for procuring seeds of this species is exceedingly small in comparison with the importance of the object to be gained ; and I, therefore, venture again to request that I may be authorized to make arrangements with Mr. Spruce for procuring a good supply of *C. Condaminea* seeds for the sum of 100 £.

I have, &c.
(signed) Clements R. Markham.

— No. 70. —

From *E. Hammond*, Esq. to *Herman Merivale*, Esq., c. b., India Office.

Sir,

Foreign Office, 2 October 1861.

IN compliance with the request conveyed in your letter of the 15th of June last, Earl Russell instructed Her Majesty's Acting Consul-General at Guayaquil to pay to Mr. Richard Spruce the sum of 100 *l.*, for the purpose of procuring a supply of seeds of the *Condaminea* species of quinine-yielding cinchona trees from the forests of Loxa; and I am directed by his Lordship to transmit to you, for the information of Secretary Sir Charles Wood, a copy of a Despatch from Mr. Mocatta, stating that Mr. Spruce declines the offer made to him on account of ill-health.

Consular, No. 30.
28 August 1860.

I am, &c.
(signed) *E. Hammond*.

Enclosure in No. 70.

From Her Majesty's Vice-Consul at *Guayaquil* to Lord *John Russell*.

My Lord,

Guayaquil, 28 August 1861.

IN conformity with your Lordship's instructions, contained in Mr. Murray's Consular Despatch, No. 5, of the 28th June last, I acquainted Mr. Richard Spruce with the wishes of Her Majesty's Secretary of State for India, and I have now to inform your Lordship that Mr. Spruce declines the offer made him, on account of the infirm state of his health.

I have, &c.
(signed) *Francis Mocatta*.

— No. 71. —

From Her Majesty's Vice-Consul at *Guayaquil* to the Secretary of State for India.

Sir,

Guayaquil, 13 September 1861.

I HAVE received instructions from the Foreign Office to pay to Mr. Richard Spruce the sum of 100 *l.* for the purpose of procuring a supply of seeds of the *Condaminea* species of quinine-yielding cinchona trees, and to draw upon you a bill for 100 *l.* at seven days after sight.

Mr. Spruce having declined the offer on account of ill-health, I have engaged the services of Mr. Robert Cross, the gardener recently employed in assisting Mr. Spruce.

As from the proceeds of my bills on the India Office,—

	£.	s.	d.
In 30 March 1860 - - - -	for	200	- -
In 28 May 1860 - - - -	„	500	- -
In 7 November 1860 - - - -	„	250	- -
In 14 January 1861 - - - -	„	50	- -

say - - - £. 1,000 - -

Mr. Spruce drew only for - - - 926 8 3

leaving a balance in my hands of - - - £. 73 11 9

In favour of the India Office, I have to advise you that I have this day drawn upon you, at seven days' sight, merely for the sum of - - - 26 8 3

to complete the sum of - - - £. 100 - -

which I am instructed to pay for the aforesaid purpose.

I have, &c.
(signed) *Francis Mocatta*,
Her Britannic Majesty's Acting Consul General.

— No. 72. —

From Her Majesty's Vice-Consul at *Guayaquil* to the Secretary of State for India.

Sir,

Guayaquil, 14 December 1861.

REFERRING to my letter of the 13th of September last, I have the honour to inform you that Mr. Robert Cross has returned successful from the forests of Loxa, bringing with him, after undergoing many hardships and overcoming the greatest difficulties, about 100,000 seeds of the *Condaminea* species of quinine-yielding trees, which I forward by this day's mail.

Of the 100 *l.* which I was authorized to place at his disposal, he has disbursed for the expenses of his mission the sum of 41*l.* 16*s.*, and I would suggest that I may be authorized to draw upon you, at seven days after sight, for that amount, in order that Mr. Cross may receive the clear sum of 100 *l.* as remuneration for services of so important a character.

Enclosed I have the honour to hand you his report,

And to be, &c.

(signed) *Francis Mocatta*,
Her Britannic Majesty's Vice-Consul.

—No. 73.—

From *R. Cross*, Esq., to the Under Secretary of State for India.

Sierra de Cajanuma, near Loxa,

9 November 1861.

Sir,

On my arrival at Guayaquil, I learned from Mr. Mocatta, Her Britannic Majesty's Vice-Consul there, that Mr. Spruce had declined going for the seeds of *C. Condaminea* to Loxa. It was further stated to me that the Government of Ecuador had passed an edict prohibiting the exportation of either seeds or plants of the quina tree, under a penalty of 100 dollars for every plant, and for every drachm of seed.* However, after consulting with Mr. Mocatta, I undertook to go to Loxa and make a collection of seeds of the *C. Condaminea*.

I left Guayaquil on the 17th of September, and proceeded in an open rowing-boat to Santa Rosa, a small town near the Gulf of Guayaquil, which I reached on the 20th. I had some difficulty in procuring mules at this place, as they are sometimes lost in crossing the first ridge of the cordillera. However, on the morning of the 21st, I succeeded in engaging the services of a peon and mules, and left Santa Rosa,† following the track which leads to Zaruma.‡ The road, or rather pathway, leads through a dense forest, which was exceedingly damp and swampy; and we encamped for the night at the base of a lofty mountain ridge, amidst incessant rain and thick dark fogs. On the 22nd, we ascended the first ridge of the cordillera, the rain still continuing, and stayed all night at an Indian hut on the mountain summit. This day, in crossing a lofty precipitous ridge, one of our mules slipped into a deep ravine, and was dashed to pieces. During our ascent, I saw many young trees of the "Red Bark," growing at an elevation of 8,000 or 9,000 feet. On the 23d we reached Zaruma, a small town situated at the base of the eastern slope of the first ridge of the cordillera. At Zaruma I found an English surgeon, suffering from paralysis, who had resided for several years in Loxa. In course of conversation with this person, I made inquiries concerning the locality of the cinchonas, but could not glean any information on that

* See Mr. Spruce's Report, p. 103.—*C. R. M.*

† Santa Rosa is the port for the province of Loxa, near the shores of the Gulf of Guayaquil, and almost due south from that town. Santa Rosa is about 80 miles from Guayaquil, by sea.

‡ Zaruma is in latitude 3° 36' south, and about 5,000 feet above the level of the sea. A good deal of sugar is sent to Guayaquil from the surrounding district. The distance from Santa Rosa to Zaruma, on Villavicencio's map, as the crow flies, is 15 miles, and from Zaruma to Loxa 38 miles.—*C. R. M.*

that point. I did not, however, make known the special object of my journey, as I had previously learned elsewhere that the doctor was in the service of the Republican Government.

On the 24th, having procured a peon and fresh mules, I left Zaruma, and began to ascend the second ridge of the cordillera. The central ridge, unlike the one I had just crossed, is barren and dry, and is in many places strewn with large masses of vitrified rocks, which are frequently mottled with the pseudo-bulbs of several species of *Orchideæ* and stunted *Cacti* and *Agave*. The mountains over which we passed were furrowed by ravines of immense depth, in which there was not a single drop of water to be found, and the aspect of the whole was of the most barren character imaginable. Our course continued over a series of ridges until dusk, when we halted for a few hours, so as to have moonlight to pursue our journey. At about 1 A.M. on the 25th, we resumed our way over extensive paramos, covered by a very coarse species of *gramineæ*, and stunted shrubby *mimosæ*. Some of the mountain ridges over which we this day passed, were narrowed to a breadth of not more than four feet, and presented on each side almost perpendicular precipices, from 3,000 to 4,000 feet in depth.

On the 27th we reached Loxa, which is situated at the base of the eastern slope of the second ridge of the cordillera.*

On the 28th I hired a peon and mules, and proceeded eastward, to reach the mountains of Zamora, a tract of country traversed by wild Indians. After a fruitless search of three days, I returned to Loxa. I did, indeed, find a species of cinchona, the bark of which is sometimes mixed with that of the *condaminea*, but it is of little value.

On the 1st of October I left Loxa, and went about eight miles to the southward, to a low long ridge of hills, called the Sierra de Cajanuma, where I had heard the *C. Condaminea* was to be found growing. As I travelled along the pathway which traverses this mountain slope, I found several young trees of the *C. Condaminea*, growing in steep, precipitous places, but no seeds were to be seen. However, I directed my course to an Indian hut, which was situated on a little rounded eminence near the summit of the mountain, intending to remain there for the night.

I found the possessor of the hut to be an experienced bark collector; and so, although it afforded but little shelter from the cold winds which sweep over the stony paramos, yet I could see at once that situated as it was, far from public roads or other dwellings, it was well suited for the accomplishment of the work. I, accordingly, located myself in a little shed at the end of the hut, wherein was a quantity of cinchona bark, and which, although favourable for the drying of seeds, was so cold that I have sometimes been compelled, during windy nights, to seek shelter in the bottom of a neighbouring ravine. I afterwards searched the lower slopes of this mountain for seeds, but although I found a considerable number of young trees, I could only gather half-a-dozen capsules. October being the month in which the seeds of *C. Condaminea* ripen, I was afraid I should not be able to secure (owing to the great scarcity of seed-bearing trees) a sufficient quantity before the season had passed away. One day, however, on passing along the bank of a steep ravine, I happened to look over a projecting rock, and saw growing on the steep slope beneath a number of fine young trees of the *C. Condaminea*, some of which bore a few panicles of seed, which, on examination, I found to be perfectly ripe. After this discovery, I continued to search all the ravines on the sierra, on which I am at present located, from sunrise to sunset, some of which I had to descend by means of the trailing stems of a species of *passiflora*, and in this way almost all the seeds sent were collected.

On the accessible slopes of the sierra, there are in general but few cinchona trees to be seen, owing, in part, to the annual burning of the slopes, and, in part, to the continual cropping of the young shoots by cattle.

The Sierra de Cajanuma, which forms part of the central ridge of the cordillera, is about eight miles to the south of Loxa. This and the adjoining mountains are mostly composed of primitive rocks,† which have, like those of the
Neilgherries

* Loxa is about 6,800 feet above the level of the sea.—*C. R. M.*

† Caldas and Humboldt say that these rocks are micaceous schists and gneiss. *Semanario*, p. 281.—*C. R. M.*

Neilgherries in India, been tilted up and heaped together by volcanic action. The rock is, in many places, in a state of decomposition, and large portions are frequently tumbling down from the more elevated summits. The alluvial deposit in the ravines where the *C. Condaminea* is found growing is shallow, in many places not more than six inches in depth; and I have often gathered seeds from trees which were growing in clefts of rock where there was not a single ounce of soil to be found.

The *C. Condaminea* is a slender-growing tree, from 20 to 30 feet in height, and from 8 to 10 inches in diameter at the base. But few trees are to be seen of these dimensions. The plants from which the bark of commerce is now taken are, in general, not more than 8 to 10 feet in height. When the plants are cut down, three or four young shoots or suckers in general spring up; but this does not always happen, as some of the more industrious cascailleros frequently pull up the roots, and bark them also. The bark is taken from the smallest twigs; thus the annual growths are sometimes taken, especially if they are strong. The plants are sometimes found growing in little clumps, and sometimes solitary, but always in dry situations. The temperature of the cinchona region ranges from 34 to 70 degrees Fahrenheit; it seldom, however, falls below 40 degrees, and rarely rises above 65 degrees. The general range of the temperature is from 45 to 60 degrees Fahrenheit.

The vegetation on the Sierra de Cajanuma is, in general, of a semi-arborescent character, but some of the higher summits, being entirely destitute of soil, are barren. The vegetation on this and the surrounding mountains is altogether remarkable, combining, in the deeper ravines, species in general prevalent in tropical and cold-temperate climates. In the bottoms of the ravines grow a species of alnus, probably *A. glutinosa*, *Pteris aquilina*, *Melastomæ*, *Peperomias*, palms, and two species of tree-ferns, growing from 30 to 35 feet in height. On the slopes, and throughout the low-lying country in the immediate neighbourhood of Loxa, barley, maize, peas, and potatoes are cultivated. The climate is certainly very similar to that of the Neilgherries, but the alluvial deposit is shallower, and is, in consequence, less favourable for the cultivation of maize, &c.

Three distinct species of cinchona are collected in the mountains of Loxa—the *C. Condaminea*,* *C. crespilla* (?) and *C. ochiluma* (?)† The latter species is not of much value. The *C. crespilla*,‡ however, is a good bark, not much inferior to the *C. Condaminea*; and I have succeeded in collecting, after several long journeys up the Sierra Grande, a few seeds of this species also. The *C. crespilla* grows at high elevations, in a deposit of peat, and where the temperature sometimes falls to 27° Fahrenheit.

I am of opinion, that the *C. Condaminea* will succeed well on the Neilgherries. There are several ravines immediately above the bungalow on the Neddawattum site, which will, I believe, be found suitable for the cultivation of this species. If the temperature does not fall below freezing-point on the Dodabetta site, it may be planted there also, and in similar situations, at about the same elevation, throughout the Neilgherries. In making plantations of cinchonas, extensive ravines ought to be selected, and the shrubs cut down and burnt. A fence should then be made along the summits of the banks, to prevent the burghers and todahs from feeding their cattle among the cinchona trees. The trees ought to be planted about seven or eight feet apart, for, after the first cutting, three or four growths of suckers will in general spring from each root; so that, in planting, this ought to be kept in view. It will not be necessary to make great roads for the conveyance of manure; indeed, such would be superfluous, as the soil on any part of the Neilgherries is quite rich enough to grow successional cuttings of the *C. Condaminea* for centuries.

The

* The *C. Condaminea*, the seeds of which have been collected by Mr. Cross, appears to be the *C. Chahuarguera* of Pavon, some account of which will be found at the end of this report, taken from Mr. Howard's work.—*C. R. M.*

† Probably intended for *Hoja de lucma*.—*C. R. M.*

‡ The *C. crespilla* is probably a variety of *C. Chahuarguera*, growing at a greater elevation. Mr. Howard says that the *C. crespilla* bears the same relation to the normal and large-grown *C. Chahuarguera*, as the *C. Josephi* does to the normal *C. Calisaya*. It will be very important to ascertain how far circumstances may have influenced the change.—*C. R. M.*

The principal aim should be to get the species multiplied as rapidly as possible, and form extensive plantations; for I am persuaded that the *C. Condaminea* will succeed on the Neilgherries.

I have, &c.
(signed) Robert Cross.

P. S.—Since writing the foregoing, I have returned to Guayaquil, with nearly 100,000 seeds of *C. Condaminea*. I trust, on arrival in England, they may be sent immediately to the Neilgherries. The seeds, together with this report, I deliver into the hands of Mr. Mocatta, Her Britannic Majesty's Consul at Guayaquil.

Guayaquil, 12 December 1861.

— No. 74. —

From *E. D. Bourdillon*, Esq., Secretary in the Public Department, to
T. Pycroft, Esq., Chief Secretary to Government, Fort St. George.

Dear Sir,

India Office, 17 January 1862.

1. HEREWITH is transmitted a parcel of seeds of the *Cinchona Condaminea*, which arrived from South America by the last mail. It is addressed to Mr. W. G. McIvor, and it is very important that it should be transmitted to its destination at Ootacamund with all possible dispatch.

2. Fifty copies of Mr. Cross's report, together with some notes on the *C. Condaminea*, compiled by Mr. Markham, will be forwarded by the next mail; and 40 copies of Mr. Spruce's report on his expedition to procure seeds and plants of the "Red Bark" are now transmitted, for the information of Mr. McIvor and others, who are entrusted with or interested in the cultivation of the cinchona plants in India.

3. Ten additional copies of Mr. Spruce's report will be forwarded, with Mr. Cross's reports, by next mail.

— No. 75. —

ORDER thereon, 17 February 1862.

1. ORDERED, that the sealed packet containing the receipt for a box of seeds sent through the Peninsular and Oriental Company by the Southampton mail steamer of the 20th January 1862, received from the Secretary of State, be forwarded to the Collector of Sea Customs; and that he be requested, with reference to para. 1 of the Despatch above recorded, to take steps without delay for clearing the box above referred to, and dispatch it to Mr. McIvor, the superintendent of Government Gardens at Ootacamund, by the nearest route with all practicable expedition.

2. The 50 copies of Mr. Cross' report and 40 of that of Mr. Spruce, alluded to in para. 2 of the said Despatch, will be duly distributed on their arrival.

(signed) C. G. Master,
Deputy Secretary to Government.

— No. 76. —

From *W. G. McIvor*, Esq., Superintendent Government Cinchona Plantations,
to *J. D. Sim*, Esq., Secretary to Government, Madras.

Sir,

Ootacamund, 12 March 1862.

1. WITH reference to the Order of Government, dated 17th ultimo, I have the honour to inform you that I received from the Collector of Sea Customs on the 4th instant, in good condition, the packet containing the seeds of *Cinchona Condaminea* and *C. crespilla*.

2. It affords me much pleasure to be able to acquaint you, for the information of Government, that a few of the same batch of seeds, which I received in a letter from Mr. Markham on the 16th ultimo, are germinating freely. On the 16th day after sowing, I found that twelve seeds had germinated, and to-day, being the 23d day, upwards of 200 seedlings have germinated, or over 50 per cent. of the total number of perfect seeds received. Judging from this result, I have little doubt that we will be able to rear nearly the whole of the seeds received on the 4th instant.

3. The Government will observe, that in this sowing of seeds, the time in which the first seeds germinated has been reduced from 62 to 16 days, and that within the 23d day a larger proportion of the seeds have vegetated than was previously effected in three months. I mention this fact, as perhaps no stronger one could be given, to show the daily improvement we are making in attaining a more perfect knowledge of the nature and treatment of these plants.

— No. 77. —

From *W. G. McIvor*, Esq., Superintendent Government Gardens, Ootacamund,
to *J. W. Brecks*, Esq., Private Secretary to His Excellency the Governor.

Sir,

Ootacamund, 4 June 1861.

1. IN reply to your letter of the 30th ultimo, I have the honour to furnish, in a brief form, for the information of his Excellency the Governor, the following remarks on the subject of your inquiries :—

2. The first sowing of cinchona seeds was made here in January last. In sowing these, I was influenced by the descriptions given of their treatment in Java, and the excessive amount of shade, moisture, and retentive soil there believed to be necessary for the germination of the seeds. I soon discovered that the seeds began to mould and damp off, and almost despaired of succeeding in rearing any; however, of this batch, from 3 to 4 per cent. germinated. The next sowing was made in the early part of March, and the soil used was of a much freer nature, one-half being composed of burned earth; of this sowing, from 15 to 25 per cent. germinated. Encouraged by this result, the third and last sowing, which was made in the beginning of April, the soil used was composed nearly entirely of burned earth; and of this sowing, about 60 per cent. germinated—of one of the varieties (*provinciana*) about 90 per cent. These results convince me that the great difficulties said to attend the rearing of the seeds, and the cultivation of the plants, do not so much lie in the nature of the seeds themselves, or of the plant, as in our ignorance of the proper treatment to be adopted.

At present I have in the gardens upwards of 2,000 plants in very promising condition. Some of the 463 imported plants are at the present moment in the most luxuriant state of health, and the remainder are now rapidly recovering from the disease and damage contracted in the Wardian cases, with a vigour which I have only seen equalled in one or two instances in the numerous species of plants I have introduced into these gardens.

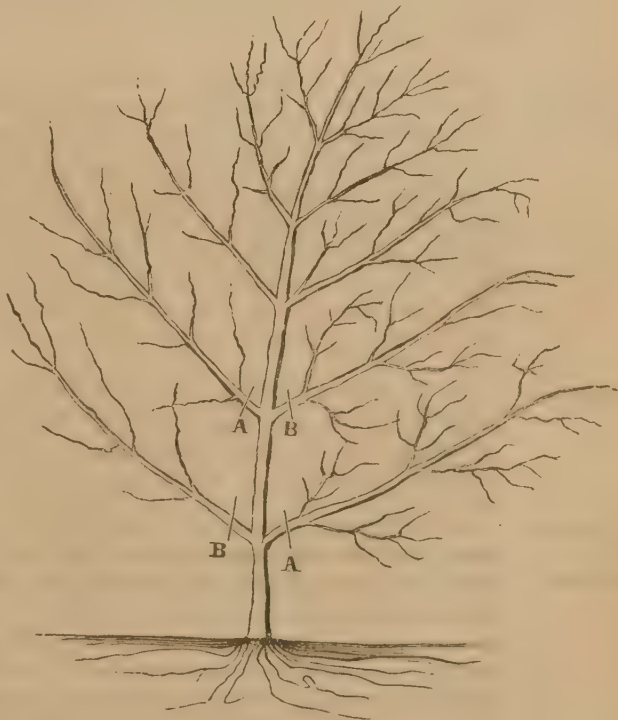
3. I possess

What has been
done in rearing
the cinchona plants
on the Hills.

3. I possess but little information on this subject, as the cultivation of the plants has hitherto not been attempted, except in Java, and this is so recent that valuable data cannot be gathered from what has been done there; their results, moreover, have as yet been unsatisfactory. It appears to me that much erroneous matter has been published with reference to the cultivation of these plants, and that we have everything to learn. For example, it is an established opinion, by parties entitled to consideration, that the plants should be grown under the partial shade of forest trees. In April last I planted three plants of the red bark, two under shade, and one in an open spot surrounded by brushwood or undergrowth. All these plants are growing luxuriantly; but since the setting-in of the monsoon, which happened on the 29th ultimo, the plants under the shade have been injured by their leaves being cut to pieces by the constant drip from the forest trees, while the plant shaded by the brushwood continues in the most luxuriant state of health, with its leaves uninjured. This experiment would indicate brushwood to be the proper shade for the plants; but from its limited nature, I do not feel myself justified in coming to this conclusion until I have made further experiments in the track thus indicated. As I have already remarked, the opinions of the authors who advocate partial shade are worthy of consideration, they having seen the plants in the various aspects of their natural forests; and in such localities they must of necessity, in the struggle for life which prevails throughout nature, grow in the shade of other plants; but these authors inform us that the cinchonas strive to overtop the forest trees to obtain light and air. On this subject I am much perplexed, but am daily gaining knowledge; so that, before any extensive planting is undertaken, I shall have satisfied myself, by actual experiment, which method will be most advantageous. The drip from large forest trees proves injurious to all plants grown under them; and I am of opinion, that while we select all that is advantageous in the natural localities of the cinchonas, we should reject all that we find detrimental. For example, Mr. Bruce informs us that he found wheat growing wild in Upper Egypt, struggling for existence among rushes and other weeds; but no one would adopt this principle in its cultivation: in like manner, too much shade may prove injurious to the cinchonas.

Cultivation of the cinchonas on the Neilgherries.

4. In the forests on the Andes the cinchona trees are cut down and stripped of their bark, and it is a generally preconceived opinion that this plan should be adopted in cultivation; but although this may be necessary, and even advisable, in the wild state, it appears a most ruinous system to put into operation in cultivation: not only is it unsuitable to the man of limited means, who requires a quick and uniform return on his capital, but it also necessitates the destruction of the plantation to produce a return at all, and this after waiting 10 or 12 years. To obviate these inconveniences, it occurred to me that the plants in cultivation should be induced to branch as near the ground as possible, and on the third year, say, the two branches at A A are cut off from their bark, they would immediately throw out fresh shoots below the line at A A. From these shoots one or two should be selected to take the place of branches removed. In the fourth year the branches at B B would be cut off in like manner, and so on until the sixth year, when the new branches formed at A A could again be removed, and so on for any number of years.



5. This treatment would ensure a quick, uniform, and constant supply of bark;

and if the pruning (as I may term it) be judiciously carried out, the trees would be benefited rather than injured by the removal annually of a few of their branches.

6. Mr. Markham, to whom I have spoken on this subject, considers it the best plan that can be adopted in the cultivation of the plants. There is, however, one objection to it:—it is, that the price of quill-bark (bark from branches) is of a little less value than the bark from the trunks. In the London market the trifling difference of 1*d.* to 2*d.* per pound is quoted. Howard, the great quinine manufacturer, in reply to the queries of Mr. Markham on this subject, states:—

“As to the plancha (trunk) bark and canuto bark (the bark of smaller branches), the former is preferred, and yields rather the most quinine; but the quill canuto also commands a good price.”

Suitable sites.

7. The sites selected near the gardens and at Neddiwattum are, I consider, well suited, and perhaps better than any other sites which could be found on the Neilgherries, from their being so conveniently accessible; but doubtless, hundreds of other sites as well suited in soil and climate could be selected. The Doda-betta, or site near the garden, has been selected entirely for an experimental plantation—*i. e.*, a plantation in which to test what amount of exposure or shade, and description of shade, of soils and subsoils, are best suited to the growth of cinchonas, and the development of their alkaloids. This site contains a great variety of exposures, and also a great variety of soils; and thus offers, for this special purpose, advantages which it would be difficult to meet elsewhere. The Neddiwattum site is a large forest of perhaps 400 acres of as fine land as is to be had on the Neilgherries, well sheltered, and in every respect, so far as I am aware, well suited to the growth of all the varieties of the cinchona, and here will be the principal Government plantation; but it is most important that we should have a higher site for experiments, in order to prove whether the cinchonas will or will not grow over the whole extent of the plateau of the Neilgherries, and this could not be established by any amount of success which we might obtain at Neddiwattum. If it proves that the cinchonas can be cultivated over the whole plateau of the Neilgherries, it will establish a fact the importance of which cannot at present be estimated, because it will open an immense field for European enterprise and energy, and, in combination with this profitable employment of capital, it will place Europeans in a healthy and invigorating climate.

Eventual disposal of plants now propagating.

8. I would propose to retain all the plants here (with the exception of a few, which will be required for experiments) till June or July next year, which is the best planting season of the year. By that time, if sufficient means are placed at my disposal, I trust to have from 50,000 to 80,000 plants ready to put out into the Neddiwattum site. My object in detaining the plants here are two: the first is to facilitate the propagation, and the second is—while we are thus accomplishing an important object in increasing our plants, we are (during the same time, which will extend over a year), by planting a few plants out under various circumstances and in different positions, ascertaining by actual experiment which is the safest method to be adopted in making our extensive plantations.

Prospect of success.

9. As I have already remarked, the plants have taken to the climate in a manner which has only been equalled by one or two of the numerous species of plants I have successfully introduced; and I am convinced that, if our operations are conducted with skill, we may obtain a success altogether unprecedented.

What I consider necessary to ensure success.

10. To ensure success, it appears to me indispensable that the officer in charge of the experiment should be left to the free exercise of his own judgment, and not required to follow any prescribed method of cultivation, which cannot lead to other than bad results. I am convinced of this, because I have gained more correct information from my short observation of the plants under cultivation, than from all that has been written and said upon the subject. If sufficient caution is exercised in conducting this experiment, and the officer in charge possesses ability to trace the effects produced on the plants under cultivation to their true causes, there exists little danger of any serious error being committed. The Government will be expected to afford efficient means, and to allow an establishment sufficient to carry out the operations to the greatest extent practicable

practicable; and it would be detrimental for the Government in future to issue orders stopping operations without reference to the executive officer, or the benefit of his opinion on the subjects the Government may be recommended to adopt. I express myself more freely in this private communication on the subject, than I did in my official correspondence, as great injury has been done to the experiment by the Order of Government of 9th March 1861, No. 552. His Excellency being anxious to obtain correct information will, I trust, excuse me for bringing this to his notice. Although what has been done here has been attempted to be deprecated to Government, I am aware, from the care and skill which I have devoted to the rearing of these seeds and plants, that when reports from other quarters of their results are received and compared, that it will be established that our success is quite unequalled. From the commencement of the cultivation of these plants (and this is the most critical period), I have had to do everything with my own hands, as I have not a man in my establishment who possesses sufficient knowledge of the nature of the plants to be entrusted even to water them. One over-watering might cause the death of the whole of the seedlings, by causing them to damp off; it is therefore of the utmost importance that a well-educated European gardener be sent out from England as soon as possible, and as the experiment progresses, two more well-educated gardeners will be required.

11. This is merely a brief outline, more founded upon supposition than any fact which I have had to guide me with reference to their cultivation; and it may prove that some alterations in these plans may have to be adopted during the progress of these experiments.

P.S.—A few leaves, showing the injurious effects of the drip, are forwarded for the information of his Excellency. The drip passes through the newly-developed leaves like a shot, and shatters and breaks the older ones.

— No. 78. —

From the Right Honourable Sir *C. Wood*, Bart., Secretary of State for India (Public), to His Excellency the Honourable the Governor in Council, Fort St. George.

Sir,

India Office, 2 July 1861.

1. I HAVE considered in Council your letter in the Revenue Department, dated 24th April, No. 63 of 1861, reporting that, "in deference to the opinions" of Mr. Markham and Mr. McIvor, you have modified your order of 9th March, No. 552, respecting the abandonment of the site for cinchonæ cultivation at the back of the Government Gardens at Ootacamund, and the relinquishment of further attempts to raise plants from seeds or cuttings in the Government Gardens. In this determination you have anticipated the directions contained in my Despatch, dated 7th June (No. 25) 1861.

2. It is, in my opinion, very desirable that the management of the cinchona experiment should be placed in the hands of Mr. McIvor, at least for the present, free from the control of other officers, and that he should, as regards this duty, be placed in direct communication with your Government.

3. The important operation of introducing the cinchonæ into India has now been successfully effected, and it is my opinion that the measures for the cultivation of these valuable plants should be framed, as far as possible in accordance with the habits of the growth of the cinchonæ in their native forests in South America, and not with reference to the mode of culture pursued by the Dutch in Java. It will, nevertheless, be well that Mr. McIvor should be kept informed respecting the proceedings of the Dutch; and as the reports of the superintendent are published in Germany, Mr. McIvor can be supplied with accurate and reliable information from time to time respecting the progress of the cinchona experiment in Java.

4. The superintendence of the cinchona plantations in the Neilgherry Hills will involve great responsibility, as well as considerable toil and anxiety; and qualifications not easily found are required for the post. I shall, therefore, be willing to sanction any reasonable allowance which you may deem it right to propose for Mr. McIvor, for the performance of this important duty.

5. With reference to paragraph 3 of your Order of the 16th April, I have to inform you that the gardener Weir has accepted other employment, but that a gardener with the requisite acquirements will be engaged and sent out to Ootacamund with as little delay as possible.

— No. 79. —

MINUTE by Sir *William Denison*.

1. I FORWARD herewith a letter addressed to my private secretary by Mr. McIvor, enclosing an estimate of the cost of the buildings to be erected, that of clearing the land, &c., for next year's plantation of the cinchona plants, and also of the permanent establishment which will be required to keep the plantations in order.

2. To this must be added :—

(1). The cost of the propagating-house, which is in progress, and will soon be completed, for which a sum of about 1,500 rupees was granted, but which will, according to Mr. McIvor, be finished for about 2,000 rupees; probably, it would be as well to insert 2,500 rupees as the cost of this, including contingencies.

(2.) Mr. McIvor's salary as superintendent.

3. These additions will raise the estimate for capital expended upon the preparation of a plantation of 160 acres to 31,076 rupees, and the annual outlay to, say, 13,200 rupees, or 1,100 rupees per month.

4. I think, however, that this will be money well laid out. The number of trees which an acre will carry is about 700, say 650; and as it is estimated that each tree will produce (after, say, 10 years' growth) 5 lbs. weight of bark annually, the yield per acre will be 3,250 lbs. (say 3,000 lbs.), and for 160 acres 480,000 lbs., or upwards of 200 tons. At 6d. per pound, which I believe to be a low price, this will give 12,000 l. per annum as the return upon the 160 acres—the annual expense of management, &c., being 1,320 l.

5. It will be seen that in the estimate a sum is taken for trenching the ground for the plants. Mr. McIvor, in his wish to keep down the estimate of first cost, proposed to put the plants in pits; I, however, suggested the propriety of trenching a portion of the ground at all events, in order to ascertain whether this would not secure a better growth than the system which he was about to adopt: this, if found to be necessary generally, will add to the first cost of the plantation, but it will be well repaid by the improved growth of the trees.

6. It appears to me that Mr. McIvor might be empowered to conduct the whole of the work, including the erection of the buildings, subject to the condition that the work, when completed, should be examined and approved by the District Engineer. It is absolutely necessary that the work should be pushed on vigorously, in order that the land should be fenced in, trenched, and prepared for planting by the end of May 1862; and the house for the overseer and men must be ready by the same time. If the responsibility of the whole is thrown upon Mr. McIvor, the Government will know to whom any blame of neglect will attach; but if the Department of Public Works is placed in charge of the erection of the buildings and wall, &c., there will be of course, in case of failure, mutual accusations between the department and Mr. McIvor, and the Government will not have it in its power to decide which was in fault. I forward herewith a return of the number of plants at present in the garden. I saw two or three

three yesterday, which had been planted out in the garden, and these appeared healthy; those in the propagating-house were in the best possible condition. Mr. McIvor was busily engaged in increasing the number by laying and making cuttings; he expects also to receive a large fresh supply of seed in October, and by the end of May 1862 to have plants enough to fill the land which he will have ready; while in the course of 1862, and the first half of 1863, he will have plants sufficient to fill 200 or 300 additional acres. The sum mentioned in the estimate will be required at once, and must be inserted in the supplementary estimate, leave being given to Mr. McIvor to proceed at once with the preparation of the land, the construction of buildings, and the wall, the object of which is to keep pigs, &c., out of the plantations; he must also be directed to send in an estimate for the Budget of 1862-63, including in that the cost of the additional clearing at Neddivattum, and the establishment for this, and for the year's plantations also. These latter will not of course be required in full strength till the middle of 1862, as the estimate for first cost provides for trenching the ground and planting out the young plants.

7. I think it would be advisable that, as proposed by Mr. McIvor, the gardener who is expected to arrive should be placed in the position of deputy—that is, should be empowered to act in all cases for Mr. McIvor both in the Botanic Garden itself, and in charge of the cinchona plants—and, as before stated, that the whole establishment should be withdrawn from the control of the Conservator of Forests.

(signed) *W. T. Denison.*

— No. 80. —

From Mr. *W. G. McIvor*, Superintendent Botanical Gardens, to *J. W. Breeks*, Esq., Private Secretary to His Excellency the Governor of Madras.

My dear Sir,

Ootacamund, 16 August 1861.

1. I HAVE the honour to enclose the estimate for the formation of the cinchona plantations on the Neilgherries, amended as suggested by his Excellency the Governor.

2. I would most respectfully propose that the European gardener engaged by the Secretary of State be placed in charge of the propagating department, and, in addition to this duty, he be required to act as my deputy in the garden during my occasional absence at Neddivattum.

3. The propagating-house sanctioned by order of Government, No. 1,328, dated 3d July 1861, being urgently required for our rapidly increasing number of plants, the work was immediately begun by me, and will shortly be completed, according to a plan and specification furnished by the engineer. This officer has also furnished an estimate, amounting to 3,680 rupees. I however believe that I will be able to finish the work, according to plan and specification, for 2,000 rupees. I would recommend that this work, when finished, be examined and reported on by the engineer, and I would wish this done with all the buildings I may erect, as a course likely to prove satisfactory to the Government and myself.

4. I enclose, for the information of his Excellency the Governor, a report of the number and condition of our cinchona plants.

ESTIMATE of Cost of Cinchona Plantations on the Neilgherries.

PARTICULARS.	Cost of forming the Plantation with Buildings, Roads, &c.	Cost of Fixed Establishment.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
NURSERY AT OOTACAMUND.		
<i>Building and other Contingent Charges.</i>		
To house for the European gardener, to consist of two main rooms 12 feet × 12 feet, and 4 verandah rooms, 6 feet × 12 feet. Walls to be built of burnt brick in clay. Fireplaces, chimneys, and corner of brick in chunam, and plastered with chunam throughout. Roof to be constructed of teak-wood, and covered with tiles. Doors and windows and flooring of two main rooms of teak-wood. Verandah rooms to be floored with flat tiles	1,200 -- --	--
To building a wall 756 yards in length, to enclose nursery ground, 5 feet high and 14 inches thick, of burnt brick laid in clay, at 1 rupee per yard	756 -- --	--
Contingent charges, at 10 per cent.	195 9 7	--
<i>Fixed Establishment.</i>		
European gardener, probable, 150 l. per annum	-- -- --	125 -- --
Head propagator	-- -- --	35 -- --
Two first assistants, at 10 rupees each	-- -- --	20 -- --
Three second ditto at 7 " "	-- -- --	21 -- --
Six gardeners at 6 " "	-- -- --	36 -- --
Six ditto at 5½ " "	-- -- --	33 -- --
One peon at 7 " "	-- -- --	7 -- --
TOTAL - - - Rs.	2,151 9 7	277 -- --

To forming a Plantation of 50 Acres of Cinchona Trees on the Dodabetta Site.

PARTICULARS.	Cost of forming the Plantation with Buildings, Roads, &c.	Cost of Fixed Establishment.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
<i>Building and other Contingent Charges.</i>		
To house for overseer, to consist of two main rooms, 12 feet × 12 feet each, and two verandah rooms, 6 feet × 12 feet, to be constructed with burnt brick laid in clay, and bamboo roof covered with tiles. Teak-wood doors and windows	560 -- --	--
To houses for 20 coolies, to be constructed with brick built in clay; bamboo roof, covered with tiles. Teak-wood doors and windows	200 -- --	--
To felling 40 acres, at 10 rupees per acre. Sopping and clearing 40 acres, at 7 rupees per acre. Pitting 40 acres, at 10 rupees per acre. Trenching 10 acres, at 180 rupees per acre. Carriage of plants for 50 acres, at 2 rupees per acre. Filling in holes, planting, and shading, at 5 rupees	3,230 -- --	--
The proceeds from the sale of firewood may be estimated to cover the cost of enclosing and finishing the construction of roads.		
Contingent charges, at 10 per cent.	399 -- --	--
<i>Fixed Establishment.</i>		
One overseer	-- -- --	40 -- --
One maistry	-- -- --	10 -- --
Five gardeners, at 6 rupees each	-- -- --	30 -- --
Twenty coolies, at 5½ " "	-- -- --	110 -- --
TOTAL - - - Rs.	4,389 -- --	190 -- --

ESTIMATE Cost of forming a Plantation of 100 Acres of Cinchona Trees on the Neddivattum Site.

PARTICULARS.	Cost of forming the Plantation with Buildings, Roads, &c.	Cost of Fixed Establishment.
	Rs. a. p.	Rs. a. p.
<i>Building and other Contingent Charges.</i>		
To house for overseer, with quarters for superintendent, to contain four main rooms 12 feet × 14 feet each, and six verandah rooms, 12 feet × 7 feet each. Walls to be constructed of burnt brick laid in clay. Chimney and corners of brick in chunam, and plastered with chunam throughout. Roof to be constructed with teak-wood king-beams; rafters of jungle-wood, with bamboo reapers, and covered with tiles - -	1,750 - -	--
To out-houses, one kitchen 10 feet × 12 feet, and two out-houses, 10 feet × 15 feet each, constructed as above - -	330 - -	--
To tool-rooms and storerooms, each 10 × 15 feet, constructed as above - - - - -	250 - -	--
To houses for 100 coolies, to consist of 30 rooms, 7 × 10 feet each, constructed as above - - - - -	1,000 - -	--
To enclosing 100 acres with a wall 5 feet high and 14 inches thick with burnt brick laid in clay, and trench outside 4 feet wide, 2½ feet deep, at 1 rupee per running yard of 3,900 yards - - - - -	3,900 - -	--
To felling 100 acres, at 15 rupees per acre. Sopping and clearing, at 15 rupees per acre. Pitting 80 acres, at 20 rupees per acre. Trenching 20 acres, at 200 rupees per acre. Carriage of plants, at 6 rupees per acre. Filling holes, planting, and shading, at 8 rupees per acre - - - - -	10,000 - -	--
To forming cart-roads 12 feet wide, over 100 acres of land, including from public road to plantation, or about 4½ miles, at 300 rupees per mile - - - - -	1,350 - -	--
To two teak-wood bridges over streams, 10 feet span each, and 8 feet wide, with stone abutments, at 85 rupees each - -	170 - -	--
To tools: 200 pickaxes, at 2 rupees each; 200 felling-axes, at 2 rupees each; 100 bill-hooks, at Rs. 1-8 each; 200 momaties, at 1 rupee each; 12 steel digging forks, at 4 rupees each; 24 steel spades, at 2 rupees each; 12 crowbars, at 3 rupees each - - - - -	1,282 - -	--
Contingent charges, at 10 per cent. - - - - -	2,003 3 2	--
<i>Fixed Establishment.</i>		
One overseer - - - - -	- - -	70 - -
One head maistry - - - - -	- - -	15 - -
Two peons, at 7 rupees each - - - - -	- - -	14 - -
Fifty coolies, at 6 rupees each - - - - -	- - -	300 - -
<i>Office Establishment.</i>		
One writer, at 20 rupees; books, stationery, ink, quills, &c., 3 rupees - - - - -	- - -	23 - -
TOTAL - - - Rs.	22,035 3 2	422 - -

Government Gardens, Ootacamund,
16 August 1861.

(signed) *W. G. McIvor*,
Superintendent Botanical Gardens.

ABSTRACT of Estimate of Cinchona Plantations on the Neilgherries.

PARTICULARS.	Cost of forming the Plantations with Buildings, Roads, Tools, &c.	Cost of Fixed Establishment.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
NURSERY AT OOTACAMUND.		
Buildings and other contingent charges - - - - -	2,151 9 7	—
Fixed establishment - - - - -	- - -	277 - -
DODABETTA PLANTATION.		
Building and other contingent charges - - - - -	4,389 - -	—
Fixed establishment - - - - -	- - -	190 - -
NEDDIWUTTUM PLANTATION.		
Building and other contingent charges - - - - -	22,035 3 2	—
Fixed establishment - - - - -	- - -	399 - -
Office establishment - - - - -	- - -	23 - -
TOTAL - - - <i>Rs.</i>	28,575 12 9	889 - -

Government Gardens, Ootacamund,
16 August 1861.

(signed) *W. G. McIvor*,
Superintendent Botanical Gardens.

REPORT on the Number and Condition of the Cinchona Plants in the Government Gardens at Ootacamund, on the 9th August 1861.

NAMES.	NUMBER.	REMARKS.
Cinchona succirubra, or red bark -	1,517	The imported plants are all in very promising condition, many of them being in the most luxuriant state of health. The largest of the plants measure 2 feet 6 inches to 2 feet 10 inches high, and some of their leaves measure 7½ inches by 11½ inches.
Cinchona calisaya, calisaya bark -	6	
Cinchona nitida, genuine grey bark	804	The average growth of the month being 1½ inches.
Cinchona micrantha, var. Provinciana - - - - -	896	
Cinchona micrantha, var. Pata de Gallinazo - - - - -	42	The maximum growth made by the most luxuriant shoots being 7 inches.
Species without name - - - - -	271	
TOTAL - - -	3,536	The first of our seedlings are from 6 to 7 inches high, and from 6 to 8½ inches in diameter across the leaves;—the average growth of the month being about 1½ inches, while the maximum monthly growth made by the most vigorous plants is 2½ inches.

Government Gardens, Ootacamund,
9 August 1861.

(signed) *W. G. McIvor*,
Superintendent Botanical Gardens.

— No 81. —

ORDER of the Madras Government, 7 September 1861.

1. IN their Order of the 16th April last, the Government directed that the cinchona experiment should for the present be restricted to the garden ravine and Neddiyattum sites, the Horticultural Gardens being also made available as a nursery and propagating place, and in any other way that might be found advisable.

Under

Under these orders, therefore, operations on any other site will not be undertaken without the express permission of Government.

2. In the same order, the operations at the selected sites were entrusted to Mr. McIvor; but doubts having arisen as to the exact degree of authority which it was intended to vest in him, the Government, in their order of the 3d July last, gave him full and entire control over the operations, holding him answerable for his conduct of them, and restricted the intervention of the Conservator of Forests to periodical inspections and reports, without, however, the power of interference except by order of Government.

Superintendence of operations.

3. In the order of the 3d July, the Government also resolved to apply to the Secretary of State for permission to raise Mr. McIvor's salary from 200 rupees to 300 rupees per mensem, in consideration of the additional responsibility and labour which this important experiment will entail on him. The Secretary of State has expressed his willingness to sanction any reasonable remuneration which this Government may propose. The Government are now in a better position to judge of the probable labour, &c. which will devolve on Mr. McIvor, and resolve to recommend that Mr. McIvor's salary be raised from 200 rupees to 350 rupees during the first year, and to 400 in the second. This remuneration is for his services as superintendent of the gardens as well as of the cinchona operations. The grant will take effect from the commencement of the current official year, and provision for it will be made in the supplemental budget.

Mr. McIvor's remuneration.

4. The Government, in April last, applied to the Secretary of State to send out Mr. Weir, as an assistant to Mr. McIvor. Mr. Weir, however, has accepted other employment; but another skilled gardener, G. Batcock, has been engaged*. He will be placed, on arrival, under Mr. McIvor's orders, and will act as his deputy both in the horticultural garden and the cinchona plantations. His salary is to be 150 *l.* per annum, commencing from the 20th August 1861, and increasing at the rate of 10 *l.* yearly. His engagement is for five years, and he is to have a suitable residence, or an allowance for house-rent.

Assistant gardeners.

* Despatch, 16th July 1861, No. 35. C. O. 4th instant, No. 1760.

5. In paragraph 5 of the order of the 3d July 1861, Government sanctioned the immediate construction of a propagating-house, at a cost of about 1,500 rupees; and in paragraph 6, Mr. McIvor was called upon for a statement of the probable monthly expenses of the experiment. Mr. McIvor has now submitted estimates to the following amount:—

Estimates of expenditure.

	Capital.	Current Monthly Expenditure.
	<i>Rs.</i>	<i>Rs.</i>
Propagating-house in the gardens, estimated by the District Engineer at 3,680 rupces, but which Mr. McIvor hopes to complete for - - -	2,000	—
House for European gardener - - - - -	1,200	—
Wall round nursery - - - - -	756	—
Contingencies - - - - -	196	—
European gardener, at 150 <i>l.</i> - - - - -	—	125
Eighteen under-gardeners - - - - -	—	145
One peon - - - - -	—	7
Nursery at Ootacamund - - - - -	4,152	277
For a plantation of 50 acres on the Dodabetta or garden ravine site:—		
Overseer's house - - - - -	560	—
Coolies' quarters - - - - -	200	—
Clearing, pitting, trenching, and planting (fencing and roads being covered by sale of timber) - - - - -	3,230	—
Contingencies - - - - -	399	—
Overseer - - - - -	—	40
Under-gardeners - - - - -	—	150
Dodabetta site - - - - -	4,389	190

	Capital.	Current Monthly Expenditure.
	<i>Rs.</i>	<i>Rs.</i>
Plantation of 100 acres at Neddiwuttum :—		
Overseer's house - - - - -	1,750	—
Out-houses - - - - -	330	—
Tool and store rooms - - - - -	250	—
Coolies' quarters - - - - -	1,000	—
Enclosing site with wall - - - - -	3,900	—
Clearing and planting - - - - -	10,000	—
Cart-roads - - - - -	1,350	—
Two bridges - - - - -	170	—
Tools - - - - -	1,282	—
Contingencies - - - - -	2,003	—
Overseer - - - - -	-	70
Fifty-one under-gardeners - - - - -	-	315
Two peons - - - - -	-	14
Neddiwuttum site - - - - -	22,035	399
Writer and stationery - - - - -	-	23
Mr. McIvor's allowance - - - <i>Rs.</i>	-	150

6. The aggregate estimate thus amounts to an outlay of capital of 30,576 rupees, or (say) 31,000 rupees, and a monthly charge of 1,039 rupees, or 12,468 rupees per annum. To the latter charge an addition of 150 rupees will have to be made in the second year, on account of the increase then proposed for Mr. McIvor, and that due under his agreement to George Batcock, who in each successive year will also draw 10 £., or 100 rupees extra.

7. Thus, for an outlay of 3,100 £. and an annual charge of about 1,300 £., the Government will have a nursery and two plantations of 160 acres of cinchonas. Each acre will contain about 700 trees, and each tree is estimated, after (say) 10 years' growth, to produce 5 lbs. weight of bark annually, for which 6*d.* per pound is a low price. Taking, however, 650 trees to the acre, and 3,000 lbs. weight only of bark, the annual produce would be 480,000 lbs., worth 12,000 £. per annum, as the return on a capital of 3,100 £., and an annual outlay of 1,300 £. The experiment, however, cannot be regarded as a mere money speculation; if successful, its results will be of incalculable benefit to the public.

8. The estimate includes a provision for trenching a part of the land. Mr. McIvor, in his anxiety to keep down the first cost, proposed to put the plants in pits. The trenching of a portion of the land was suggested by the President, and if found successful will be extended; and the improved growth of the plants will compensate for the additional expense of this mode of preparing the ground.

9. The Government resolve to authorize Mr. McIvor to conduct the whole of the operations, including the erection of the buildings, subject to the condition that the work, when completed, shall be examined and approved by the District Engineer.

10. The work will be pushed on vigorously, in order that the land may be fenced, trenched, and prepared for planting by the end of May 1862. The houses for the overseers and labourers must also be ready by that time.

11. The Accountant-General will accordingly provide, in the supplemental budget, for an outlay of 31,000 rupees on buildings, &c., and of 7,000 rupees for establishments, or 38,000 rupees in all. Pending the sanction of the Supreme Government to the budget, the Collector of Coimbatore will be authorized to make such advances as may be necessary from time to time on Mr. McIvor's receipts, to be subsequently adjusted. The Accountant General will furnish the Collector with the necessary instructions.

12. The Accountant General will also instruct Mr. McIvor to prepare his budget estimate for the year 1862-63, in due form and time.

13. Under

13. Under the orders already noticed, Mr. McIvor has been placed in an independent position as regards the cinchona experiment, and the Governor in Council resolves to place the botanical gardens similarly under his entire control. The preliminary operations of the cinchona experiments are conducted in the Botanical Gardens, where the propagating house now sanctioned will be constructed, and it will be embarrassing if Mr. McIvor has not full power over the gardens as well as the cinchona plantations. Mr. McIvor will, therefore, be under the direct orders of Government in both these departments, as laid down in General Order, 3d July last.

14. These proceedings will be communicated to the Secretary of State and the Government of India.

(signed) *J. D. Sim,*
Secretary to Government.

—No. 82.—

From the Government of Madras to Sir *Charles Wood.*

Madras, 6 July 1861.

1. WE have the honour to forward, in continuation of our Despatch of the 24th April last, further papers relative to the experiment, which is now being tried on the Neilgherries, of introducing the cinchona tree into Southern India.

2. Mr. McIvor has complained of certain remarks made by Dr. Macpherson, as disparaging his mode of treating the cinchona seeds, and requested an inquiry; but we informed him that compliance with his request was unnecessary, as the fact of our having entrusted him with the charge of the cinchona operations on the Neilgherries, was itself a proof that he had not lost our confidence. Captain Morgan, on his part, offered to draw up a paper of information as to proper sites, treatment of seeds, potting plants, erecting glass-houses, &c.; but although we appreciated his offer, we considered the preparation of such a paper to be unnecessary at present.

3. We desire to draw your particular attention to the very interesting reports of Mr. McIvor, which will be found recorded in our Proceedings of the 3rd July; and we feel confident that you will be gratified to receive such promising accounts of the experiment so far as it has progressed. "At present," Mr. McIvor writes, "I have in the gardens upwards of 2,000 plants in very promising condition. Some of the 463 imported plants are at the present moment in the most luxuriant state of health, and the remainder are now rapidly recovering from the disease and damage contracted in the Wardian cases, with a vigour which I have only seen equalled in one or two instances in the numerous species of plants I have introduced into these gardens." There has been some misapprehension as to the degree of power which we intended to vest in the superintendent of the Horticultural Gardens at Ootacamund in respect to this experiment; we have, therefore, placed this matter beyond doubt, by giving Mr. McIvor full and entire control over the operations, holding him answerable for his conduct of them. The Conservator of Forests will, however, periodically inspect and report on his operations, but he is not to interfere with them, except by our express orders. We believe this to be the most judicious course, because very little is yet known of the culture, &c. of the plant, and the experiment is manifestly one which needs professional knowledge and experience, and constant care; and in Mr. McIvor's zeal and ability we have great confidence.

4. Our great object at present is to propagate a large number of plants, leaving the establishment of plantations in different localities to follow hereafter, when a sufficiency of plants has been raised to place the experiment beyond risk of failure; and with this view, we have prohibited the gratuitous issue or sale of seeds and plants until the experiment is safe, and have granted 1,500 rupees for the construction of a propagating-house: when the introduction of the plant is beyond doubt, we shall afford every facility to persons desirous of cultivating it.

5. In consideration of the much additional trouble and responsibility entailed on Mr. Melvor, we beg permission to raise his allowances from 200 rupees to 300 rupees at once, as we do not think it fair that his remuneration should be deferred until the work is accomplished. We consider him justly entitled to the additional salary we have proposed, and considering the importance of the experiment entrusted to him, we hope you will accede to our recommendation. We address you on this subject, instead of the Government of India, because this experiment has been carried on under your direct instructions.

— No. 83. —

From Sir *C. Wood* to the Governor of Madras.

Sir,

India Office, London, 9 August 1861.

1. WITH reference to para. 3 of my Despatch, dated 2d July (No. 27) 1861, I now transmit 50 copies of the translated report of the Dutch superintendents of cinchona plantations in India. In the same packet 50 copies are transmitted of a pamphlet, compiled by Mr. Markham, containing botanical descriptions (together with notes and observations) of all the species of cinchonæ now growing in India; and 50 copies of Mr. Pritchett's report on the cinchona region of Huanuco, in Northern Peru.

2. You will also supply one or more copies of these pamphlets to the different agricultural and horticultural societies in India, in order that the useful information they contain may be as widely circulated as possible.

His Excellency the Honourable
the Governor in Council, Fort St. George.

I have, &c.
(signed) *C. Wood*.

—No. 84.—

From the Right Honourable Sir *C. Wood*, Bart., Secretary of State for India,
to His Excellency the Honourable the Governor in Council, Fort St.
George.

Sir,

India Office, 14 September 1861.

1. I HAVE considered in Council your letter in the Revenue Department, dated 6th July (No. 89) 1861, transmitting further correspondence respecting cinchona cultivation; and I learn with great satisfaction, from the interesting reports of Mr. W. G. McIvor, the increasing numbers and highly flourishing state of the cinchona plants under his charge.

2. Your resolution to entrust Mr. McIvor with "full and entire control over the operations," is in accordance with the opinion expressed in my Despatch of the 2nd July last; and in conformity with the intention which I then stated, I authorise, in compliance with your present recommendation, the increase of Mr. McIvor's salary from 200 rupees to 300 rupees per mensem.

— No. 85. —

From Sir *C. Wood* to the Governor General.

My Lord,

India Office, London, 2 July 1861.

I HAVE considered in Council your letter dated the 26th of April, No. 25 of 1861, forwarding a communication to the Governor General of the Netherlands India, on the subject of measures to be adopted relative to the introduction of the cinchona plant into India.

2. You

2. You will have perceived from my Despatches, dated 7th June (No. 25) and 2d July (No. 27) 1861, to the Madras Government, that the conclusions to which they were led by Dr. Macpherson's representations, were erroneous. That Government has since seen occasion to modify the view then adopted. From more recent intelligence, it appears that the plants in some instances, and the seeds generally, in the Government gardens at Ootacamund, are progressing very favourably. You will also perceive from the above-mentioned Despatches, that I have directed the Madras Government to leave the management of the undertaking in that Presidency under the immediate control of Mr. McIvor, the superintendent of the Government gardens at Ootacamund, who, from his experience in gardening, and from the advantages he has derived from personal intercourse with Mr. Markham and the gardeners under him, who have studied the nature of the trees in their native forests, appears in every way suited to the post. It will, therefore, be unnecessary to enter into any engagement for the services of Dr. Croneman, or any other gentleman connected with the Dutch Government, with reference to the cultivation of this plant in the Madras Presidency. With regard to the cultivation of the cinchona, which you may think it expedient to adopt in other parts of India, it will probably be better to depend mainly upon the plants and seeds obtained under the present expedition, than to trust to the exchanges which may be made with the Dutch Government, whose largest collection, there is ground to believe, consists of a species of the plant of a very inferior description.

I have, &c.
(signed) C. Wood.

— No. 86. —

From the Government of India to Sir *Charles Wood*, Secretary of State for India.

Sir,

Fort William, 25 July 1861.

In continuation of our letter, No. 25, dated the 26th April, we have the honour to transmit, for your information, the accompanying copy of a communication, dated the 13th ultimo, from the Governor General of the Netherlands India, regarding a supply of cinchona plants and seeds. We also forward copy of the reply made to his Excellency, and of a letter addressed to the Government of Fort St. George.

2. We purpose, either next month or in September, to send Dr. Anderson, the officiating Superintendent of the Calcutta Botanical Gardens, to Java, to receive charge of the plants and seeds which are promised by the Netherlands Government.

We have, &c.,
(signed) *Canning,*
H. Rose,
H. B. E. Frere,
R. Napier.

Enclosure 1, in No. 86.

From the Governor General of Netherlands India to His Excellency the Viceroy and Governor General of British India.

Buitenzorg, 13 June 1861.

In reply to your Excellency's letter of the 23rd April 1861, No. 816, I have the honour to inform you that the successful issue of the cultivation of the Peruvian bark in the Island of Java enables me to place at the disposal of the British Government 500,000 seeds, about 100 or 200 seedlings of the *Cinchona lucumæfolia*, and from 50 to 100 plants of the *Cinchona Calisaya*. These seeds will be forwarded as soon as possible.

As to the young plants, it is the opinion of Dr. Junghuhn, principal inspector of the said cultivation, that they should be carefully packed in boxes, according to the method prescribed by Ward, and entrusted (during the transit) to the charge of an intelligent person, well instructed beforehand in the mode of treating them.

To ensure as much as possible the safety of this consignment, Dr. Junghuhn has suggested the appointment of Mr. Markham to this mission, an arrangement which will have the advantage of bringing these two gentlemen together, and affording Dr. Junghuhn the opportunity of imparting to Mr. Markham whatever information his personal experience has enabled him to collect.

This proposal seems to me the more deserving of your Excellency's attention as, in the opinion of Dr. Junghuhn, Dr. Groneman of Bandong, who accompanied Mr. Macpherson over a part of the plantations, and who is alluded to by your Excellency towards the end of your letter, is not equal to the important task which your Excellency would seem inclined to entrust him with.

To promote the undertaking in question, I have deemed it advisable to subjoin here some general rules to be observed in regard to the cultivation of the cinchonas:—

1. The seeds should be set for the purposes of germination in borders, situated from 4,500 to 5,000 feet above the level of the sea, and well sheltered.

2. The *Cinchona Calisaya* succeeds best in Java at an elevation of from 5,000 to 5,700 feet, whilst the *Cinchona lucumæfolia* can be planted even 1,300 feet higher.

3. To prevent the shoots from degenerating and not attaining their full perfection, the plantation of the bark should always be under the shelter of forests.

Dr. Junghuhn is of opinion that it is of the highest importance to select the ground in accordance with these data.

Enclosure 2, in No. 86.

From his Excellency the Earl Canning, Viceroy and Governor General of India, to his Excellency the Governor General of the Netherlands India (No. 1391).

19 July 1861.

I HAVE had the pleasure of receiving your letter, dated the 13th June, on the subject of a supply of cinchona plants and seeds, and I beg to tender to your Excellency my warm acknowledgments for the liberal spirit in which my request in this matter has been responded to.

2. I propose that some competent person should proceed to Batavia by the mail steamer of next month, in order to receive charge of the plants and seeds which your Excellency is kind enough to promise. Mr. Markham, whose name has been suggested to your Excellency by Dr. Junghuhn as a proper agent for the purpose, is at present in England, and his services cannot, therefore, be made available; but care will be taken to select an intelligent person well fitted for the important duty, and with the advice and assistance of Dr. Junghuhn, I shall feel little doubt of the attainment of a successful result.

3. Again offering to your Excellency my cordial thanks for your courteous and friendly communication, I remain, &c.

Enclosure 3, in No. 86.

From W. Grey, Esq., Secretary to the Government of India, to T. Pycroft, Esq., Chief Secretary to the Government of Fort St. George.

19 July 1861.

IN continuation of my letter, No. 844, dated the 23d April, I am directed to forward, for the information of his Excellency the Governor of Madras in Council, the accompanying copy of the communication received from the Governor General of Netherlands India, regarding a supply of cinchona plants and seeds, and to state that the Governor General in Council proposes, either next month or in September, to send Dr. Anderson, the officiating superintendent of the Calcutta Botanical Gardens, to Java, to receive charge of the plants and seeds which are promised in this communication.

2. Dr. Anderson will be instructed to convey the plants to Madras, using his discretion, however, as to leaving any of them in Ceylon, which it may appear to him hazardous to carry on. Due notice will be given hereafter of the period at which Dr. Anderson may be expected to arrive at Madras, in order that arrangements may be made by the Madras Government for the prompt removal of the plants to the localities selected for them.

— No. 87. —

From Sir *Charles Wood* to Lord *Canning*.

My Lord,

India Office, London, 24 October 1861.

I HAVE considered in Council your letter, dated 23d July (No. 51) 1861, informing me of the measures you have taken, with regard to the offer of the Governor General of Netherlands India to place a number of plants and seeds of two species of *Cinchona* at your disposal. I observe that the Dutch Government offers 50 to 100 plants of *C. Calisaya*, and this addition to the small stock of that valuable species in the Neilgherry Hills will be very acceptable; but, at the same time, I have to inform you, that it has been decided by the first botanists in this country, that the species, called by the Dutch, *C. lucumæfolia*, of which they offer 500,000 seeds and 50 to 100 seedlings, is quite worthless. I, therefore, desire that no expense whatever be incurred in connexion with this species; and that, if not too late, the liberal offer of the Dutch Governor be accepted, only so far as the plants of *C. Calisaya* are concerned.

2. A copy of this Despatch will be transmitted to the Madras Government.

I have, &c.
(signed) *C. Wood*.

—No. 88.—

Extract from *W. Grey*, Esq., Secretary to the Government of India, Home Department, to *T. Pycroft*, Esq., Chief Secretary to the Government of Fort St. George.

Sir,

Fort William, 9 December 1861.

1. I AM directed to forward to you a copy of a report submitted to the Government of India by Dr. Anderson on his return from Java, together with a copy of the reply made to him.

2. Dr. Anderson will leave for Madras to-morrow morning, and will arrive, therefore, simultaneously with this letter. His first care will be to superintend the removal of the plants which he has in charge to the Neilgherry Hills, for which it is hoped that all necessary preparations will have been made under the orders of His Excellency the Governor in Council.

Enclosure in No. 88.

From *Thomas Anderson*, M.D., Officiating Superintendent of the Botanic Gardens, Calcutta, to *W. Grey*, Esq., Secretary to the Government of India.

4 December 1861.

1. I have the honour to report my return to Calcutta on the 28th November from Singapore, with seven Wardian cases containing 412 young and very healthy plants, and 400,000 seeds of species of cinchona, obtained from the cinchona plantations in the Island of Java. I have secured a passage to Madras by the mail steamer of the 10th; the plants ought, therefore, to reach their destination at Ootacamund about the middle of this month. In a demi-official letter from Java, dated 26th October, I briefly reported my progress up to that date. The plants I have now brought were made over on the 7th November at the nursery of Tijaneroian on the Malabar Mountains, 180 miles from Batavia.

2. Dr. Junghuhn most liberally placed at my disposal, 100 plants of *Cinchona Calisaya*, about 300 of *C. Pahudiana*, and six of *C. lancifolia*. Of the first of these species I considered only 56 plants strong enough to undergo the risks of the long voyage to Madras, and accordingly I had the number of *C. Pahudiana* increased to 350. A larger number of *C. lancifolia* was also offered to me, but only six seemed at all likely to survive the journey. Of those six one has died, the only casualty among the 412 plants. *C. lancifolia* is in the young state a succulent rank plant, forming little or no wood, and accordingly exceedingly liable to damp off when transported to a warm climate. From Tijaneroian the Wardian cases were brought by coolies to Batavia, under the charge of the principal native gardener of the Calcutta Botanic Gardens. He rode alongside of them all the way, travelling only

by night, and resting with the plants by day, under the dense shade of a fig-tree (*Ficus nitida*) found in all Javanese villages. I went in advance with Dr. DeVrij to examine the original cinchona plantations of the Dutch, where all the original plants from South America are, and where also all the accidents and failures occurred which at first threatened the entire extinction of the experiment. At Buitenzorg, I halted for the arrival of the cinchona plants; and after having seen them again, I proceeded to Batavia, to make arrangements for their voyage to Singapore. My great aim was to detain the plants as short a time as possible in the hot climate of Batavia. The cases reached Batavia late on the night of the 13th November, and were shipped on board the Batavian and Singapore steamer on the evening of the 14th. I sailed from Batavia on the morning of the 15th. After a pleasant passage of three days through a perfectly smooth sea, we arrived at Singapore on the evening of the 18th. My intention was to have remained at Singapore until the arrival of the Peninsular and Oriental Company's steamer from Hong-Kong, and to have proceeded by it to Galle, there to land the cases and wait the arrival of the mail steamer from Suez, and by it take a passage to Madras. However, on my arrival at Singapore I found the Calcutta and Hong-Kong steamer "Lightning" about to sail for Calcutta, and I at once saw the advantage of proceeding by that route in preference to going by Galle. By going to Calcutta the plants would have 10 or 12 days in a cool climate, almost identical, in temperature at least, with that of the cinchona plantations of Java; they would have every convenience for resting in shade, and abundance of careful attendance, and would also escape the risks which would be incurred by landing and re-shipping heavy cases in the harbour of Galle in the hurry of coaling and landing cargo. Lastly, no time would be lost, as by this route I shall reach Madras quite as soon as if I had gone by Ceylon. After leaving Penang, a fungus appeared on nearly all the plants, and this rendered necessary the unpacking and re-packing of all the plants in the cases, a work which has occupied the head European gardener and several natives for three days. All traces of the fungus have been most carefully removed, and the moss with which the pots were packed has been dried. Advantage was also taken of this shifting of the plants to dispense with two unwieldy Wardian cases lent to me in Java. The plants contained in these were placed in three light cases of the pattern used in this garden. I stated in my demi-official letter that the information freely imparted to me by the scientific gentlemen in charge of the cinchona cultivation was one of the most important parts of my mission. Much of this information referred to questions of proper elevation above the sea, mean temperatures of atmosphere and soil, exposure to sunlight, clearing of the forests, nature of the soil, and position of the plantations on the mountains, as well as to points of purely chemical interest. There can be no doubt that, on the whole, there will be greater difficulties to contend with in introducing cinchona into India than have been experienced by the Dutch in Java. Dense forests possessing a moist climate, do not occur extensively in Southern India at elevations from 3,000 to 6,500 feet high, which may be taken roughly as the two extremes at which the cultivation of species of cinchona will be most successful. The site selected at Ootacamund is, as Mr. Markham allows, at least 1,500 feet above the highest elevation at which *C. Calisaya* is found in Bolivia, and 2,000 feet higher than the upper limit at which, after numerous experiments, it has been found possible to grow that species in Java, four degrees nearer the Equator than Ootacamund. Mr. Markham seems to forget that the lines of mean temperature are, even near the Equator, not parallel with degrees of latitude, and how much more do they vary when the points compared are mountain chains whose every phase of climate is influenced by local causes? If the *Cinchona Calisaya* is planted in a scantily wooded "Shola" whose elevation is 7,830, and the highest 7,950 feet above the sea, the young plants will most certainly be lost. Besides elevation and meteorological considerations, it is also necessary, in selecting a site for a cinchona nursery, to take into account the proximity and extent of forest that will be available for the permanent site of the trees. It will cause a large increase of expense at the first planting, and great additional labour in attending to the trees afterwards, if the product of a nursery must be distributed over circumscribed patches of forest far removed from each other. A small ravine containing a forest about a mile broad, and whose upper limit is only 4,000 feet above the sea, will accommodate a very small number of trees requiring dense shade, and whose height when full grown will probably exceed 80 feet. Such a patch of forest at Mercara is described by Mr. Markham as well suited for a cinchona plantation. Judging from the papers published by the Madras Government, the same remark applies to all the sites chosen in Southern India. Forests of the limit of 1,000 acres, and the Neddiwuttum site of 400 acres would be stocked by the hundredth part of a year's produce of a Java cinchona nursery. In Java, where the Dutch have entered on the cultivation on a most extended scale, the nurseries, which are only nine in number, are in the centre of vast forests where many square miles of forest are available for receiving the young trees from each nursery. In many places on the volcanic range of the Malabar in Java, I have ridden for three or four hours through a plantation of cinchona extending for 4 or 500 yards on each side of the path. Such liberal views of what is necessary for the success of so important an undertaking as the naturalization of the quinine-yielding cinchonas contrast strongly with the imperfectly formed plan on which this cultivation has been commenced in India.

3. In reading the official papers published by the Madras Government, I have also noticed that no provision seems to be made for selecting different sites for the various and numerous species already introduced into the nursery at Ootacamund. It may be generally said, that each species of cinchona requires a peculiar treatment for it to attain its highest development

development, and this is shown by each species of cinchona being found in South America within limits suitable to itself alone. This fact has been fully admitted by the Dutch, and they have attempted to imitate in the nurseries and plantations the natural conditions in which each species is found. This difference among the species has also attracted the notice of Mr. Thwaites, the director of the Royal Botanic Gardens of Ceylon, and who is charged with the superintendence of the introduction of cinchona into that island. He tells me, that that valuable species, *C. succirubra*, is quite a tropical plant, and succeeds well at Peradenia, the tropical botanic garden of Ceylon. Of course such a species cannot be expected to flourish in sites ranging from 7,000 to 7,800 feet in elevation. I have many other facts to record and many more remarks to make, suggested by what I have observed in Java; but it is quite impossible for me to allude to them now, with all the pressing duties of my office, which must be attended to before I leave for Madras. I shall, however, have the honour to submit this report in an extended form, embracing the whole subject of the introduction of cinchona, soon after my return from Madras.

4. In conclusion, I consider it my duty to recommend that a definite plan should be drawn up, in the most liberal spirit, having for its aim the means of procuring the largest possible amount of quinine in the shortest possible time. Its details ought to include provision for the immediate establishment of nurseries on all the mountain ranges suitable for the cultivation of any of the species, and where large tracts of forest are available, such as the Khasia Hills, the Eastern Himalayas, the mountains extending from Chittagong down to the Malayan Peninsula. On all of these ranges at least *C. succirubra* will thrive, and it is one of the richest in quinine of all the species of cinchona. A nursery and plantation might at once be organised at the northern slopes of the Khasia, where the rainfall is only 150 to 200 inches in the year, and where forests are tolerably abundant. Should this be sanctioned, I would propose to leave in the Botanic Garden of Calcutta a sufficient number of the plants I brought from Java to commence a plantation, and seeds to form a nursery. I would suggest that not more than 10 plants of *C. Calisaya* and about 60 of *C. Pahudiana* be left here; to these I can add 32 seedlings of various species which were raised here in April, and which in two months will be strong enough to stand the journey to the Khasia Hills. With a little care these plants I propose to leave here can be kept in perfect health until the middle of March.

— No. 89. —

From *W. G. McIvor*, Esq., Superintendent Government Gardens, Ootacamund,
to *J. D. Sim*, Esq., Secretary to Government, Revenue Department.

Sir,

Ootacamund, 2 August 1861.

1. WITH reference to the order of Government on the introduction of the cinchona plants from Java, I have the honour to solicit the favour of your being good enough to bring to the notice of Government, that the value of the species and the correctness of the names given to some of these plants in Java is at present involved in much doubt and uncertainty.

2. In a letter which I had the honour to address, on the 18th ultimo, to the private secretary to his Excellency the Governor, I mentioned, "that the bark (and specimens of the leaves and flowers) of the cinchona, called by the Dutch *lucumæfolia*, have recently been forwarded from Java to Mr. Howard for analysis. The bark has proved to be worthless, and the species to be one of no value, and is now named *Cinchona Pahudiana*."

3. Although these remarks are forwarded on private information, it is of such a nature as will not admit of doubt as to their correctness. Moreover, I see that the information which I received has since been confirmed by the public notice of the plant by J. E. Howard, Esq., in the proceedings of the Linnæan Society of the 2d May 1861, and also in the "Gardener's Chronicle and Agricultural Gazette" of 25th May, as a new species, but one of little value, except as a botanical specimen, the flowers being very ornamental.

4. This species was first called "ovata" by Hasskarl, and since "*lucumæfolia*" by Dr. Junghuhn, and now named "*Pahudiana*" by Howard, in honour of the Governor General of Java. It is very probable that Dr. Junghuhn was not aware of the result of Howard's analysis and investigation at the date of the correspondence recorded in the Proceedings of Government. I observe that a large number of this species has been very liberally offered by the Governor General of Java, and I consider it my duty to give this brief but plain statement of the facts connected with this plant, so far as I have been able to ascertain them,

in order to enable your honourable Government to decide as to whether it is advisable or otherwise to incur the cost of introducing and cultivating this species.

5. The *Cinchona Calisaya*, of which from 50 to 100 plants are also liberally offered, is a species of undoubted value, and its introduction may be worthy of consideration. However, we already possess six plants of this species, in very fine health, and 50 or 60 more are expected from Kew in October; we have also every reason to expect a large supply of seeds from Peru, but we cannot possess too many plants of this valuable species. Seeds of this species from Java would be very desirable, as their transit would cost little.

6. The third species they have in Java, named *lancifolia*, is also very valuable, but none of this is offered, and it is questionable if they could be spared, as 14 is given as the total number of plants in Java. This (the *lancifolia*) is only a variety of the *Condaminea*, which grows on high and exposed situations. I learn from Mr. Markham that he has made arrangements with Mr. Spruce for the extensive introduction of seeds of the *Condaminea*, and I am informed that I may expect the seeds to reach me in November.

7. The other species in Java, *Cinchona lanceolata*, is very doubtful, but no analysis has been made of it, as they have, as I believe, only a few (45) plants.

8. I enclose, for the information of Government, a report on the number and condition of our cinchona plants, taken on the 9th July; since that time about 400 more seedlings have come up.

9. I also beg to enclose copy of hints for the treatment of plants in Wardian cases, which may prove useful to the gentleman entrusted with the importation of the plants from Java; the treatment there described has been practised here for many years with the best results.

— No. 90. —

REPORT on the Number and Condition of the Cinchona Plants in the Government Gardens at Ootacamund, on the 9th July 1861.

NAMES.	NUMBER.	REMARKS.
<i>Cinchona succirubra</i> , or Red Bark -	1,204	The imported plants are in a very healthy and flourishing condition, the leaves on some of the red bark plants measuring 11×7 inches. Average growth of the month, 1½ inches; height of largest plants, from 2 feet 4 inches to two feet 7 inches.
<i>Cinchona calisaya</i> , Calisaya Bark -	6	
<i>Cinchona nitida</i> , genuine Grey Bark -	714	
<i>Cinchona micrantha</i> , var. Provinciana -	802	
<i>Cinchona micrantha</i> , var. Pata de Gallinazo -	36	
Species without name -	211	The first of the seedlings are 4½ inches high, and furnished with from two to three pairs of branches; some of the leaves measure 2½×1½ inches. Average growth of the month, 1¼ inches. More seedlings are coming up daily.
TOTAL - - -	2,973	

Government Gardens, Ootacamund,
9th July 1861.

(signed) W. G. McIvor,
Superintendent Botanical Gardens.

Hints on packing and conveying Plants in Wardian Cases.

THE cases to be furnished with a false bottom, raised about two or three inches above the true bottom by bars of wood of the thickness required, being nailed on the underside; through this false bottom holes are bored at regular distances; over these holes let a few broken pieces of pot be placed, and over this a layer of

of moss—the case being filled with soil to within two or three inches of the level of the glass, and the plants carefully planted pretty close together, so as to allow of a case containing 35 or 50 plants according to their size.

The best sort of soil I believe to be formed of equal parts of leaf-mould, turfy loam, and sand; these should be mixed in a dry state, and if possible spread out and exposed to the action of the sun for a few days prior to being put into the cases.

During the voyage the plants should have plenty of light and air, in fine weather one side of the case being left open for two or three hours morning and evening; the soil being every three or four days turned up on the surface to the depth of about half an inch, with a small pointed stick, and always kept rough (never smooth) on the surface.

The object of this is to allow the air to circulate among the soil, and this circulation of air is also facilitated by the false bottom. This is, perhaps, one of the most important things to be attended to in transporting plants in Wardian cases, as the action of air on the soil keeps the roots in fine condition, and entirely prevents the formation of mildew and damp, which so frequently prove fatal to the roots of plants in Wardian cases. The plants should have water when the surface becomes decidedly dry, but they should not be soaked with water: the proper amount of moisture to preserve roots in a healthy state, is only what the soil can retain in its cavities by the force of attraction. The principal object of the false bottom is to allow any excess of water to drain off into a place where it cannot sour the soil, and yet not to be lost, for as the soil becomes dry above the water, it will be attracted to it. The true bottom of the cases should be watertight, and in stormy and bad weather, the cases should be shut up tight, to prevent the possibility of salt water getting to the plants; but should this happen, which it ought not to do, the only means of preserving the plants is immediately to wash them with fresh water.

Ootacamund,
22 July 1861.

(signed) W. G. McIvor,
Superintendent Botanical Gardens.

— No. 91. —

From W. G. McIvor, Esq., Superintendent Government Gardens, Ootacamund,
to J. D. Sim, Esq. Secretary to Government, Revenue Department.

Sir,

Ootacamund, 6 August 1861.

1. On re-perusing the correspondence recorded in the order of Government, dated 29th July 1861, and with reference to my letter of the 2d instant, I fear I have not entered so fully on the subject of the importation of cinchona plants from Java as its importance requires. I would, therefore, most respectfully explain that from the 500,000 seeds of the *Cinchona lucumæfolia* liberally offered by the Governor General of the Netherlands India, we may expect to rear upwards of 400,000 plants, as this is a species most luxuriant in its growth, producing seeds of greater vital powers than the ordinary species of cinchona.

2. To afford suitable accommodation for this number of plants will cost about 10,000 rupees, and to attend to them will require one man to every 2,000 plants, or an establishment of 200 men for the first year; at the end of the first year, the land necessary to plant this number of plants may be estimated at 1,200 acres; at 50 rupees per acre, for preparing, pitting, and planting, will cost 60,000 rupees. The establishment necessary to keep up this extent of land, at two men to the acre, gives 2,400 men, at six rupees each, or a monthly expenditure of about 14,000 rupees, not including overseers, tools, &c. I believe this will prove an unprofitable expenditure of public money, and one which will only lead to ultimate loss and disappointment; and, under these circumstances, I respectfully beg to explain that I cannot be responsible for the results in the cultivation of this species.

3. The course I purpose to pursue in this important undertaking, is only to cultivate species of known and established value; all that are the least doubtful, should only be grown to a limited extent, and after they have fairly and un-

mistakeably developed their qualities, their cultivation can be extended, or otherwise.

4. This line of procedure appears to me indispensable, to avoid disappointment, as not only many, but the majority of the species of cinchona, are worthless for the production of quinine.

P.S.—Since writing the above, I observe that Professor Lindley, in a review of Howard's work, states: "We have omitted to mention the appearance of the seventh part of Mr. Howard's superb work on Cinchonas, or Illustrations of the Neuva Quinologia of Pavon. It contains figures of *Cinchona Uritusinga*, *nitida*, and *Pahudiana*, a new species now cultivated in Java by the Dutch, but of inferior quality; it seems, however, to grow freely, and would be a good hothouse shrub, bearing panicles of pale vermilion flowers as large as lilacs."

— No. 92. —

From the Chief Secretary to the Government of Madras to *W. G. McIvor*, Esq.,
Superintendent of Government Gardens, Ootacamund.

Sir,

Fort St. George, Madras, 14 December 1861.

I AM directed by his Excellency the Governor in Council to inform you that Dr. Anderson, of the Bengal Medical Service, has been deputed by the Government of India to visit the Neilgherries, for the purpose of inspecting the nurseries of the cinchona plants there, and of satisfying himself as to the prospect which they give of ultimate success.

2. Dr. Anderson will leave Madras to-morrow morning, and may be expected at Ootacamund on the 17th instant. I am to direct that you will place yourself in communication with him, and will afford him all possible information and assistance in furtherance of the duty with which he has been charged.

(signed) *T. Pycroft*, Chief Secretary.

— No. 93. —

From Mr. *W. G. McIvor*, Superintendent Government Cinchona Plantations, to
T. Pycroft, Esq., Chief Secretary to Government, Madras.

Sir,

Ootacamund, 20 January 1862.

WITH reference to your communication of the 14th ultimo, No. 1649, I have the honour to acquaint you, for the information of Government, that during Dr. Anderson's stay on these hills, I furnished that gentleman with every information regarding our operations; and at his request he was carefully instructed in our process of propagation and cultivation of the cinchonas, which the filling of our new propagating-house afforded him the means of observing in all its details. Dr. Anderson expressed himself highly gratified by our system of propagation from layers, being a method not usually adopted, and one which greatly facilitates our means of increasing these valuable plants. Dr. Anderson has also been furnished with the plans of our propagating-house, in order that he may erect two similar buildings on the Himalayas, so as to enable him perfectly to follow the method of propagation practised here.

2. So far as our operations have yet extended, our success is indisputable and quite unequalled, but a difference of opinion exists between Dr. Anderson and myself as regards one of the next steps I am about to take, namely, that of planting out 75 acres of cinchona plants without the shade of forest trees; this Dr. Anderson thinks, will prove disastrous, although there can be no objection to this opinion being placed on record; in order, however, that the Government may be satisfied that I have not come to any hasty conclusion as to the various modes of culture it is desirable to pursue in our experiments, I beg to be permitted to detail the facts which have influenced me in forming an opinion.

3. As

3. As already brought to the notice of Government, we propose planting during this year in all 150 acres. Of this 75 acres will be planted under various degrees of shade of forest trees, and 75 acres planted without any shade of forest trees.

4. With reference to the first method, the advantages which it offers are these:—the cultivation can be conducted with little skill, as under dense shade all will be left to nature, and in reality no cultivation required; the plants would also look well to the casual observer, although drawn and watery. Its disadvantages are these:—the period when we can expect quinine, or bark, will not arrive until our cinchona plants overtop the forest trees and expand their heads in the open sunshine, and this will take from 40 to 60 years; and it is doubtful if some of the most valuable species of cinchona would ever overtop the forest, but die out, as described at para. 11; the plantations would also have to be felled to obtain the produce.

5. It will be observed, that under this system of cultivation, and with the necessity of destroying the plantations to get the produce, the growth of Peruvian bark would never become an article of private enterprise; and it is doubtful if Government plantations would ever be found on a scale sufficiently large to affect the value of quinine in the market.

6. With reference to the second system, its advantages are:—if successful, it will furnish bark in eight years from the date of planting, and in 12 years the bark will become an article of commerce. The plantations will not have to be cut down or destroyed in order to obtain the produce, but uniform and constant yearly supplies of bark will be procured without any damage whatever to the trees. Thus the production of Peruvian bark will be placed within the reach of the ordinary speculator, and even within the reach of the man of limited means; and as it would be profitable, it will no doubt soon become an extensive article of produce. Its disadvantages are these:—to get the trees over the first year or two of their growth will require a great amount of skill and attention. The ground, being cleared of the forest, will be exposed to the full effects of evaporation and radiation, and this in a limited degree, although beneficial in promoting the fertility of the soil, in excess no doubt will be injurious, but this injurious action can be more simply and efficiently combated by other means than the shade of living trees.

7. The arguments against this method advanced by Drs. Macpherson and Anderson, who visited the cultivation in Java, have received my full and serious consideration, and from all I can gather the whole seems to have originated in a misconception of facts. It is believed by Dr. Junghuhn, the principal director of cinchona cultivation in Java, that the cinchona trees in their natural localities on the Andes “grow in damp forests overshadowed by trees.” But the greatest authority* contradicts this conclusion and their practice, and states that the only species they have cultivated to any extent, viz., the *C. lucumæfolia*, or, as it is now called, *pahudiana*, “grows in a very sandy micaceous soil, on dry sunny hills without much shelter from the sun.” But were it so that the cinchona trees grew in damp forests overshadowed by trees, still it would be difficult to come to a conclusion more erroneous than that in cultivation such was desirable or necessary; because, in the localities where plants are indigenous, there is always one or more conditions the most favourable to the perfect development of the plant, but there are also other conditions which are injurious, and one of these is invariable overshadowing and overcrowding.

8. Our minds not being fixed as to the best culture to be applied to a newly introduced plant, the absurdity of the above conclusion does not appear in such full relief as if the same principles and facts were advanced to guide us in the treatment of plants long in cultivation. Suppose any one were to dictate to the agricultural world that they must grow their tea, coffee, cotton, wheat, barley, &c. &c. &c., among thorns, briars, and weeds, because they must of necessity grow

* Howard's 7th No. of Nueva Quinologia de Pavon.

grow under such circumstances in a state of nature, it would be received as the production of a wandering mind, although the facts would be correct, and only the conclusion erroneous. All terrestrial plants which have been brought into economic cultivation from the beginning of the world up to the present time have been found to be benefited by full exposure to the light of heaven; and no facts have yet been advanced to show that the cinchonas are likely to form an exception to this general rule.

9. In coming to a conclusion as to the course desirable to be followed in our experimental cultivation, I have been much guided by the opinions of Mr. Markham. This gentleman, commissioned by the Secretary of State for India, visited South America in 1860, penetrated into the cinchona region, and, being an excellent observer, noted with great minuteness the various influences as affecting the growth of these valuable plants. Mr. Markham visited India at the end of the same year, and, by numerous notes and a long personal intercourse, conveyed to me every particular of his observations, and this intercourse afforded us the great advantage of being able fairly to discuss the best means of applying a system of culture suited to meet the different conditions of our climate.

10. The correctness of Mr. Markham's observations has stood the test of practical experience, without failing as yet in one instance; and it would be unreasonable to conclude they will fail when applied to the future stages of our operations, especially as his means of observation have been of the most perfect nature. I do not for a moment doubt the high scientific attainments of Dr. Anderson; but this gentleman has only seen in Java the plants in a very doubtful state of cultivation, and therefore is more liable to form an erroneous opinion. Moreover, the Java system of rearing seeds had at the instance of Dr. Macpherson a fair trial here, and when compared with the results we otherwise obtained it proved a failure.

11. The opinions of Mr. Markham are also borne out by every authority who possessed the same advantages as himself, namely, that of studying the habits of the cinchonas in their natural localities. Mr. Howard believes that the cinchonas "delight" in exposure to "free air, cold, water, and sunshine." Poeppig states, that with the bark collectors "all stems were rejected, even when they stood in very promising groups (*Manchas*), if the soil was damp and the valleys warm and without a current of air." Dr. Karsten states, "For the bark of the cinchona growing in the ravine described, high above the actual limits of the forest, gave three-and-a-half per cent. sulphate of quinine, whilst that from the lower-lying forest scarcely yielded one per cent." Weddell suggests, that in cultivation the cinchonas be planted in cleared ground along with faster-growing plants; and this would no doubt be a good system, were it not that the faster-growing plants would take up a great proportion of the nourishment from the soil, which would be more profitably stored up in the cinchonas. Mr. Cross, a very intelligent young gardener, engaged by Mr. Markham to assist him in his mission, states in the notes he furnished to me: "I observed that many of the red bark trees, when growing under dense shade, lost a portion of their branches, and sometimes all of them, during the wet season; or, if not, they assumed a weak climber-like habit, which, if exposed suddenly at any time to influences of a damp or dry nature, would be likely to cut them off altogether."

12. Much has already been, and no doubt will be, demonstrated in actual cultivation, to show various modifications in applying the principles above given, with the greatest advantage to the conditions of our climate and soil; but, until this experience is had, it appears safest for us to endeavour to administer to the plants in the highest degree, those conditions which have been ascertained to be most favourable to their perfect development on the Andes, and to remove or mitigate such as are injurious.

13. Our present success is only comparatively satisfactory, and this we can only expect to be the case in our future operations; as had I possessed at the beginning the same experience I have even now, nearly double the results would have been obtained; also with reference to our system of cultivation and propagation,

gation, although comparatively perfect, yet no doubt it will ultimately give way to one very much superior, when we become better acquainted with the nature of the plants; but these improvements will be effected only by a modified application of the same principles, as we cannot expect to violate with impunity any of the laws which govern vegetable life.

14. I shall now briefly notice the present condition of our experiment, as the coldest and the greatest part of our dry season has now passed away, and it gives me much pleasure to be able to state that all our cinchona plants in the open air have borne this unusually severe winter without injury. In September last I planted at Neddiwattum six plants of different species in a cleared spot on the highest and most exposed point of the site, and all of these have not only borne the cold and drought without injury, but it has never checked their growth, and at present the plants are in the finest possible state of health, their leaves of the deepest green, some of which measure 9 by 12 inches.

15. At Ootacamund I planted 15 plants between May and August, and 12 of these were of the red bark; being the most tender species, I wished to test the amount of cold and exposure it would bear. Here the cold of December checked the growth of these plants, but has not in the least injured them; the leaves still keep their deep-green colour, and measure from 7 to 9 inches. This plant is evidently more hardy than we at first supposed, as a plant of *Fuchsia serratifolia* (growing within two feet of the red bark) had the points of its tender shoots killed by frosts, while even the young leaves of the red bark were not touched.

16. The plants in our propagating-houses continue to grow with their usual vigour. The largest of those growing as specimens measure 4 feet in height, and the circumference of the stem above the ground measures $3\frac{1}{2}$ inches, at 18 inches above the ground $2\frac{1}{2}$, and at 3 feet $2\frac{1}{4}$ inches. The strongest growing plant that we have, is one that has been layered and consequently short, but the circumference of the stem at the ground measures over 4 inches. The total number of our plants at present is about 9,000, of eight different species. Of these upwards of 3,000 have attained a size fit for propagation; the others are necessarily small, but making satisfactory progress. Dr. Anderson was furnished with 204 plants of our most valuable species for introduction in Bengal, and 16 have been forwarded to Mr. Maltby for the Rajah of Travancore. On taking the plants out of the Wardian cases which Dr. Anderson brought from Java, they were all more or less affected by rot and fungi at the roots. Three of the *Calisayas* have died since being transplanted, two more are doubtful, but the others seem to be recovering.

(No. 284).

ORDER thereon, 22 October 1862, No. 2263.

1. THE Government consider this report very satisfactory.

2. Mr. McIvor will forward brief monthly reports of the progress of his various operations, noting especially the condition of the plants at Neddiwattum.

(signed) *T. Pycroft*, Chief Secretary.

Enclosure in No. 93.

REPORT on the Number and Condition of the Cinchona Plants in the Government Gardens at Ootacamund and Neddiwuttam on the 31st January 1862.

NAMES.	Number of Plants.	Value per lb. of Dry Bark in the London Market.	
		s. d.	s. d.
1. Cinchona succirubra, or Red Bark - - - - -	6,580	2	6 to 8 9
2. Cinchona Calisaya—Calisaya, or Yellow Bark - - -	67	2	10 „ 5 -
3. Cinchona lancifolia, Brown Bark - - - - -	4	1	8 „ 2 10
4. Cinchona nitida, or Genuine Grey Bark - - - - -	1,000	1	8 „ 2 9
5. Cinchona species without name - - - - -	308	1	8 „ 2 10
6. Cinchona micrantha, var. Provençiana - - - - -	1,713	1	8 „ 2 9
7. Cinchona Peruviana, or Grey Bark - - - - -	60	1	8 „ 2 10
8. Cinchona Lucumafolia of the Dutch, or Pahudiana of Howard - - - - -	425	No value.	
Total Number of Plants - - -	10,157		

REMARKS.—The whole of the plants are in very fine condition, many of them being in the most luxuriant state of health. The largest of the plants are from 3½ to 4½ feet in height, and some of their leaves measure over 12 by 18 inches. The circumference of the stem of the largest plant measures 3½ inches at the ground, at 18 inches above the ground the same stem measures 2½ inches, and at 3 feet above the ground 2¼ inches.

The thickness of the bark in these plants is very remarkable, being in some instances a quarter of an inch, and on the smaller stems the average thickness considerably exceeds that of the wood. About 3,000 plants have been placed in the nurseries in the open air; these are making very satisfactory progress. For experiment, six plants of different species were planted out in September last, in a cleared spot, on the highest and most exposed part of the Neddivattam site. All of these plants have borne the cold and drought without injury, their growth not having been in the least checked. At Ootacamund the growth of the red bark plants was checked by the cold and drought of December and January; but the weather now being more mild, they have again begun to grow. Of the cuttings put into the new propagating house in the beginning of January, about one-half of them were found on the 28th to be rooted, the roots varying from a quarter to one and a half inch in length; all species seem to root alike freely on a bottom heat. The number of cuttings lost from damp and accidents has averaged from 6 to 10 per cent. With the *Calisayas*, which takes long to root without bottom heat, we obtained the following results:—of 24 cuttings put in on the 1st of January, at the end of the month two had died, 11 were rooted, and the remaining cuttings had quite heeled over and begun to emit roots, which will be perfectly developed in from 8 to 12 days. On removing the plants brought by Dr. Anderson out of the Wardian cases, they were all found to be more or less affected with rot and fungi at their roots; since being transplanted, three plants of the *Calisaya* have died, two are doubtful, as also one of the plants of *C. lancifolia*; the others are now recovering, and seem to have fairly taken to the soil.

(signed) W. G. MELVOR,
Superintendent Government Cinchona Plantations.

— No. 94.—

From Thomas Anderson, Esq., M.D., Officiating Superintendent Royal Botanic Gardens, to W. Grey, Esq., Secretary to the Government of India.

11 February 1862.

I HAVE the honour to report my return from the Neilgherries on the 13th January, after having made over to Mr. Melvor at Ootacamund 50 plants of *Cinchona Calisaya*, Wedd. in excellent condition, with the exception of one sickly and one almost dead, 284 plants of *C. Pahudiana*, Howard in perfect health, also four plants of *C. lancifolia*, Mut. in excellent order. These four are the only plants of *C. lancifolia* that have ever been introduced into India. I have thus completed the special duty with which I was entrusted, and nothing now remains for me but to lay before His Excellency the Governor General in Council the results of my investigations in Java and in the Neilgherries, as well as of my study since 1854 of the subject of the introduction of the species of cinchona into India.

2. In

2. In my demi-official letters addressed to you, and in my public letter No. 326, dated 4th December 1861, I have remarked on the very liberal manner in which the plants and seeds of cinchona were given to me by the Dutch authorities; but as none of these communications were adapted for publication, I shall here briefly detail my proceedings in Java, as well as the manner in which I was received there.

3. I reached Batavia on the 5th October, and on reporting my arrival to Alexander Loudon, Esquire, the General Secretary, I was invited to proceed at once to Buitenzorg, in order that I might have an interview with the Honourable M. Prins, Acting Governor General, and to present my letters from the Government of India. After an audience with His Excellency, orders were passed, allowing me the free use of the Government post-horses during my travels, and a passport to visit all parts of Java was also presented to me. Orders were also issued to Dr. De Vrij, the gentleman charged with the chemical investigation of the bark of the cinchona, directing him to meet me at Bandong, a large town in the centre of the western portion of the island, and in the vicinity of the cinchona plantations. I had apartments given to me in the palace of Buitenzorg, until the carrying out of these arrangements would permit my departure for Bandong. At Bandong I met Dr. De Vrij on the 14th October, and the next morning we started in company for Loro Kedeol, a temporary wooden dwelling erected for Dr. Junghuhn at 6,500 feet in the vicinity of the cinchona plantations on the Kendeng Mountains, distant about 50 miles from Bandong. There we awaited the arrival of Dr. Junghuhn, who joined us on the following day accompanied by Baron Von Richthofen of the Prussian embassy to Japan. We resided for some days at Loro Kedeol, making daily excursions to the cinchona plantations, and also visiting two active volcanoes. I made very extensive collections of plants illustrative of the flora of this mountain chain, having engaged for this purpose about 20 coolies, who worked under the guidance of my two trained plant collectors. I took advantage of Baron Von Richthofen's being of our party, to have the observations confirmed which I made on the geology of the mountains selected for the cultivation of cinchona. That gentleman is travelling as geologist to the Prussian embassy, and is also known by a large work on the Geology of the Tyrol. On all occasions I was accompanied by Dr. Junghuhn, who carefully pointed out to me the experiments he had made in the various cinchona nurseries, explaining fully all the details, and satisfying my curiosity on every point. During our rides through the primeval forests, sites suitable for cinchona plantations were always noted, and the reasons for selecting them freely discussed.

Dr. Junghuhn, from his extensive knowledge of the natural history of Java, was able to give me information of the most valuable kind concerning the distribution of the trees and plants occurring in the cinchona plantations. In his great work on Java, and in his "*Plantæ Junghuhinanae*," to which most of the first botanists of Europe have contributed monographs, these facts of botanical geography are all recorded, but they acquired additional interest and value when communicated by Dr. Junghuhn on the scene of his labours and with special reference to the cinchona cultivation. After visiting six nurseries and the adjoining plantations, and examining the cinchona plants that were to be made over to me, we returned to Bandong, which I made my head quarters, and where my botanical collections were accumulated. After a few days at Bandong spent in arranging and examining my collections, Dr. De Vrij and I started for Limbang, the residence of Dr. Junghuhn, at the foot of the great active volcano Tankuban Prah. Here we found Dr. Junghuhn suffering from a severe attack of dysentery, caused by exposure while travelling during the past six weeks; when I left Java, three weeks later, he was still seriously ill. Dr. De Vrij and I ascended to the summit of the volcano, and we also visited the recently formed cinchona nursery on this mountain, and the young plantation in the forest. I found it was impossible for me to reach Batavia, as I had hoped, in time for the first steamer in November. I was therefore able to devote some days to visit the district of Garood, an extensive plateau, about 2,000 feet above the sea, called, on account of its wonderful beauty and fertility, the Garden of Java. It is surrounded by lofty volcanic mountains, and to their slopes also Dr. Junghuhn has proposed to his Government to extend the cultivation of cinchona. We spent four days here, ascending three active volcanoes, one of which had

recently erupted, exploring the forests on their sides, and visiting also one of those depressions in the mountain side where the skeletons of animals suffocated by noxious gases are constantly to be found. We saw in it the recent skeletons of a wild hog and of *Felis minima*. On my return to Bandong, I despatched the native gardener, whom I had brought from Calcutta, to the nursery of Tjaneroen, in order to accompany and take charge of the Wardian cases containing the cinchona plants, on their journey to Batavia. After again visiting Limbang to take leave of Dr. Junghuhn, I proceeded on my way to Batavia accompanied by Dr. De Vrij. We diverged, when about halfway to Batavia, in order to visit Tjibodas, the only cinchona plantation I had not seen, except one in the eastern part of the island. The plantation of Tjibodas is the one in which occurred all the accidents and failures that attended the introduction of the plant into Java. We spent four days here, passing one night on the summit of the Pangerango, the loftiest mountain in the west of Java, 10,000 feet high. Dr. De Vrij then returned to Bandong, and I pursued my journey towards Batavia. At Buitenzorg I had the honour of an interview with his Excellency Baron Von Sloet, the Governor General of the Netherlands India, who had arrived from Holland during my absence in the interior. When thanking his Excellency for the facilities that had been given me for seeing all that had been done for rendering the experiment successful in Java, I took the opportunity of mentioning that several very valuable species of cinchona had been received in British India, besides *C. Calisaya*; and that I was authorised to state that, if desired, plants of these would be placed at the disposal of the Dutch Government. I reached Batavia on the 11th November, and sailed on the 15th for Singapore. There I found the China steamer about to sail for Calcutta, so I at once took a passage by it, arriving in Calcutta on the 28th November.

4. At the Botanic Gardens here the plants were carefully cleaned and re-packed by Mr. Scott, the head gardener, a portion of them being retained to form the nucleus of a nursery in the Khasia Hills.

5. On the 10th December I sailed for Madras with the greater portion of the cinchona plants, and an experienced native gardener to take charge of them. All the necessary arrangements had been made at Madras for my proceeding to the Neilgherries, so that there was no delay or detention, and I arrived at Ootacamund on the 17th December.

As I mentioned in the commencement of this report, only two plants had suffered from the journey. Mr. McIvor was directed by his Excellency Sir William Denison to put himself in communication with me, and to afford me all possible information and assistance in furtherance of the duty with which I had been charged. The short period that my duties in Calcutta allowed of my spending in the Neilgherries, was entirely devoted to the study of the cultivation of cinchona in these mountains. All the sites that Mr. McIvor had selected were carefully visited, their geology, meteorology, and botany examined, and their characteristics noted; while the hitherto very successful cultivation and propagation of *Cinchona succirubra*, and other valuable species, in the conservatories and recently erected propagating-house in the Government gardens at Ootacamund, were fully explained to me in all their details.

6. I took advantage of my possessing eight empty Wardian cases, in which I had brought the cinchona plants from Java, to bring to Calcutta a large quantity of all the available species of cinchona at Ootacamund, to add to the stock reserved for the experiment in this Presidency. These arrived in tolerable order, considering the loose manner in which Mr. McIvor, from want of time, was obliged to pack them. About 13 plants out of 204, the entire number received, have been seriously damaged; the remainder, in the present genial climate of Calcutta, have quite recovered, and are as healthy as they were at Ootacamund.

7. I cannot conclude this portion of my report without referring to the great interest taken in my expedition by the officials of the Government of Netherlands India. I was received with marked courtesy by the Honourable M. Prins, President of Council, then Acting Governor General. From this gentleman, and from Alexander Loudon, Esq., General Secretary to Government, I received most valuable assistance and direction. To the Resident of the Preanger Regencies I am indebted for the promptness with which the ample relays of coolies were provided for the carriage of the Wardian cases, as well as the horses for my own use,

use, during the long journey from the cinchona plantations to Batavia. To Mr. Yellinghaus, Assistant Resident at Bandong, my thanks are due for constant services rendered during my prolonged stay in his district; and to the Native Prince, the Regent of Bandong, whose guest I was for several days at his resting-houses in the more inaccessible districts, where he sent furniture and servants for my use. Above all, I desire to bring to the notice of his Excellency the Governor General in Council, the unremitting kindness and attention of Dr. Junghuhn and Dr. DeVrij, and the unreserved manner in which all information that I could desire on our daily journeys was imparted to me. Messrs. Jardine, Skinner & Company, and Messrs. Apcar & Company, liberally allowed me to take the Wardian cases containing the cinchona plants, to and from Singapore, free of charge in their steamers. The same privilege was granted by the Peninsular and Oriental Company on my return from Madras with the cinchona plants.

8. The season is now too far advanced for the despatch of plants to Java; and the plants at the Neilgherries are not at all adapted for transmission to a distance, as plants artificially propagated, as they have been, cannot bear the risks of a long journey without a few months' preparation. Of those I brought the short journey from the Neilgherries to this, I lost nearly 10 per cent., while the plants from Java, which were seedlings, can hardly be said to have suffered at all. I shall reserve a set of plants from the first cuttings made from the plants from Madras, at present in the Botanic Gardens here, and by a preparatory process they will be rendered hardy enough for despatch to Java about the middle of November. I shall communicate with Dr. Junghuhn concerning the necessary arrangements for the transport of the plants from Singapore, where I shall send them in charge of one of the native gardeners who accompanied me to Java. The species of which I shall be able to send plants to Java are *Cinchona succirubra* of Pavon (not the plant known under that name in Java, which I consider a variety of *C. ovata*), *C. nitida*, *C. micrantha*—all valuable quinine-yielding species.

General Account of the Introduction of Cinchonas into Java and India.

1. The importance of such a subject as the introduction of cinchona into India, and the ignorance among gardeners of the proper methods of treatment of the various species, from the fact that no species of the genus has ever been cultivated except in Java, have given rise to a series of pamphlets and letters containing a great deal of irrelevant matter. I have before me six pamphlets, containing 286 pages of printed matter, besides 142 pages of printed correspondence, on this subject, which, with the exception of one or two short letters, have all been published during the last nine months. Of these, four pamphlets are translations, by Mr. Markham, of Latin botanical descriptions of species of cinchona, from the works of the well-known authors, Weddell and Howard, and notes extracted from the publications of the German botanists and travellers Karsten and Poeppig. The remaining two pamphlets are inaccurate translations of Dr. Junghuhn's second report on the cinchona in Java, one by Mr. Markham, the other by Mr. Fraser, under the auspices of Dr. Macpherson.

2. In this report Dr. Junghuhn gives an interesting account of the first introduction of the plant into Java. It is, therefore, unnecessary for me to enter into any details now, beyond stating that the first plants were introduced in the end of 1854. Mr. Hasskarl, the horticulturist who brought the plants from South America, and Mr. Teysmann the gardener (*hortulanus*), in charge of the Botanic Gardens Buitenzorg, were entrusted with the cultivation of the plant. Their efforts were followed with so little success, that in 1856 the direction of the cultivation was made over to Dr. Junghuhn. Dr. DeVrij, Professor of Chemistry at Rotterdam, was afterwards appointed to assist Dr. Junghuhn in the chemical researches into the quality of the cinchona bark produced in Java. The result of their exertions is that from 43 plants of *C. Calisaya* Wedd., 30 of *C. lancifolia* Mut., two of a variety of *C. ovata* (called *C. succirubra* by Dr. Junghuhn, but not that species), and 64 of *C. Pahudiana* Howd., have been produced about 8,000 plants of *C. Calisaya*, and more than half a million of *C. Pahudiana*, and a corresponding increase in the number of the other species.

3. In Java, the principal plantations are situated on the Kendeng and Malabar range of mountains, in the southern portion of the island, in south latitude

7 deg. 20 to 25 min., and east longitude 107 deg. 20 to 35 min. These mountains, rising from the plateau of Bandong, 2,000 feet above the sea, to 6,000 or 7,000 feet, are covered to their summits with a dense forest of gigantic trees. The forest is continuous, except where broken by the sight of a solfatara or the crater of an active or extinct volcano. On leaving the rice cultivation of the plateau, and commencing the ascent of the mountain, to reach, for example, such a plantation as that of Kawa Tjividei, we pass first the beautiful and extensive coffee plantations; the coffee plants (untopped) are 20 or 30 feet high, their stems covered with mosses or with such orchids as *Vanda tricolor*, and *Celogyne speciosa* or *Javanica*. Trees of *Erythrina Indica* have been planted among the rows of coffee trees, to give the shade which they require. Occasionally, especially as we approach the upper border of the plantations and the ascent becomes steep, specimens of that giant of the forests of the Malayan Archipelago *Liquidamber altingiana* are noticed raising their bare smooth stems, without a branch or an epiphyte, to the height of 150 or 180 feet, where they terminate in a leafy head. On leaving the coffee gardens, we enter a dense forest, where on every hand we see the tree-ferns *Alsophila contaminans*, several species of *Cyathea*, the wild plantain, many broad-leaved *Zingiberaceæ* such as *Amomum*, *Hedychium*, *Elletaria*, *Pininga*. The forests are choked with an undergrowth of these plants and with *Araliaceæ*, such as *Sciadophyllum*, *Panax*, and other scandent shrubs, with *Urticæ* and numerous *Rubiaceæ* such as *Morinda*, *Canthium*, *Vangueria*, *Paederia fœtida* and *tomentosa*, *Pavettæ* of several species, and *Chasalia*. The numerous branches of these bushy shrubs become entwined with prickly-leaved scandent palms, principally *Plectocomia* and *Calamus*, and a sub-scandent bamboo, which I referred to the beautiful species *Bambusa elegantissima*, Hassk. Gigantic figs occur in this region, and, with their enormous aerial roots and high well-branched stems, form the most striking objects in the vegetable kingdom. With the exception of the Rasamala (*Liquidamber Altingiana*), the stems of the trees are covered by a dense mass of epiphytic orchids, ferns, *Lycopodia*, and mosses; they hang from the branches in long festoons, and quite conceal the bark on all parts of the tree. Conspicuous among these epiphytes is the *Asplenium Nidus-avis*, whose mass of plantain-like light-green leaves, closely appressed to the trunk, may be observed on almost every tree. On the forked branches of some of the older trees, at this elevation (5,000 feet), the *Rhododendron Javaniacum*, an epiphyte with deep orange-coloured flowers forming a large head, attracts attention even from a distance. As we ascend through the dripping forest, the vegetation changes with the altitude, and at 6,500 feet types of a temperate flora are more abundant, though mingled with tropical forms able to resist the somewhat lower temperature. The larger forest trees are *Podocarpus cupressina*, *P. Junghuhniana*, *P. Nereifolia*, *Memecylon costatum*, *Astronia macrophylla*, and *M. laurifolia*, *Gordonia Wallichii* with several Laurineæ, especially *Tetranthera* and *Cyclodaphne*. The abundance of oaks is also a peculiar feature in these forests; such species as *Quercus spicata*, *Pseudomolucca Sundaica nitida* and *Junghuhn*, with the nearly allied genera of *Lithocarpus* and *Castanea*, are common. Shrubby *Melastomaceæ*, indicative of the dampest climates, grow epiphytically on the stems of the trees, having their roots buried in the thick covering of mosses, hymenophylla, and other ferns. One of the most beautiful genera of this order is *Medinilla*, of which 16 species are found in these forests. Two species of *Polyosma* represent the gooseberries and currants of the northern forests of Europe and America, and the temperate genus *Rubus* abounds in species. Epiphytic *Solanaceæ* and *Cyrtandrea* also occur constantly in the moistest spots, proving the perpetual humidity of these forests.

4. The dense foliage and the mass of spongy matter in the shape of mosses, entwined roots of epiphytal orchids, and ferns suspended overhead on the branches, intercepts a great deal of the heavy rain, and forms an effectual shelter for the traveller, who has, however, a more serious inconvenience to fear than rain from the falling of dead branches, broken off under the weight of moisture in their mossy coating. The upper zone of these mountain regions, from 7,500 to 10,000 feet, possesses a vegetation of even a more temperate character, such as one or two species of *Clematis*, *Thalictrum*, *Ranunculus*, *Violaceæ* and *Berberideæ*, *Saxifragæ* represented by the Himalayan genus *Astilbe*, the temperate *Rhododendrons*, *retusum* and *albiflorum* with *Gaultheriæ*, and several species of *Vaccinium*, and one species of the eminently American genus *Gaylussacia*.

lussacia. As we approach the craters of the active volcanoes, the luxuriant forest becomes stunted and scorched, even blackened, by the action of noxious gases, and is at length succeeded by a peculiar volcanic flora, consisting of a few gregarious plants, which are able to resist the irritating fumes of the sulphuretted hydrogen and other gases given off from the crater. Among these plants are *Leucopogon Javanicus*, *Gaultheria punctata* and *leucocarpa*, *Thibaudia vulgaris*, *Syzygium rostratum*, with *Pteris incisa* and *Selliguea*.

5. The climate of these forests is one of almost equal temperature with abundant moisture. There is no markedly dry season, as in Southern India and the Western Himalayas; but the rainy period, commencing in the end of September, lasts until the end of June, but occasionally rain falls throughout the entire year, as happened in 1861. The annual rainfall varies from 180 to 250 inches, according to the exposure, but the moisture in the atmosphere is much greater than any amount of rainfall would indicate. On all the mountains of Western Java, the dew-point, during nine months of the year, is at saturation.

6. All the cinchona forests are at those elevations where the afternoons are misty and rainy. Such a record as the following may be taken as a general account of the meteorological conditions of nearly every day for nine months, and sometimes for the entire year, at the height of 6,500 feet:—At sunrise (the thermometer being about 48 or 50 degrees) the sky is unclouded, and the sun shines brightly and warmly until 10 o'clock; while the valleys and plains below are hidden in a dense covering of clouds, out of which the higher ranges of mountains stand like islands in a sea. As the air becomes warmer and the sun's heat increases, these clouds rise up from the plain and begin to ascend the mountains, or, more properly, the moisture in the ascending warm currents becomes condensed on coming in contact with a colder upper stratum of air on the mountains, and about 11 o'clock the sun is hidden at all elevations above 4,500 feet, while it shines brightly in the plains. On the summit of the Panerango, 10,000 feet high, I observed my thermometers, which at 6 P.M. stood at 47 degrees Fahrenheit, rise at 9 P.M. to 49 degrees under the influence of a heavy fall of warm rain, brought up by a moist wind from below. This rise to 49 degrees was equal to four degrees above the proper temperature, which at 9 P.M. ought to have been 45 degrees. About an hour after noon, rain commences, and increases in quantity until near sundown, ceasing gradually about midnight, the clouds sinking down into the valleys. After midnight, the temperature is lowered by radiation under the almost cloudless sky. The range of the temperature is, however, small, both for the daily variation and the annual range. The difference between the maximum and minimum is from 10 to 12, while, from the proximity to the equator, the annual variation at Bandong is only about 2½ degrees.

7. Observations on the temperature of the air and the rainfall have been instituted at all the cinchona plantations of Java, except the small one in the eastern part of the island. The mean annual temperature of the cinchona nurseries varies from 62 to 66 degrees, and it is at these temperatures that the plants thrive best, when placed in the forest.

8. *Geological structure*.—The mountains on which the cultivation has been commenced are all volcanic in their structure, the rocks being principally trachyte and its varieties. In the neighbourhood of the more active volcanoes, such as Mount Gedeh, where the cinchona garden of Tjiboddas is placed, a deep layer of volcanic dust covers the soil. The steep slopes of the precipitous porphyritic mountains of the extreme west of the island have been avoided.

9. *On the Dutch method of cultivating Cinchonas*.—The nurseries for the propagation of the cinchonas are always at the lowest point of the site selected for the plantation, in order that the delicate process of germination may be carried on in the warmest spot. A tolerably flat place is chosen for the overseer's house and the nurseries, and it is usually cleared from all trees and brushwood. The nurseries are long and narrow raised beds of earth, arranged in terraces on the gentle slope, and protected from the sun and rain by low sheds, lightly thatched. Under these sheds, the young cinchona plants are raised from seed in bamboo pots, placed on the beds of earth. At the nursery of Tjineroen there are one or two propagating pits (slightly sunken glazed houses) for the artificial propagation of such species as do not

bear seed. In these houses the valuable species *C. lancifolia* has been largely increased by cuttings. In the open nurseries, where the seedlings are raised, the following plan is pursued:—The bamboo pots, made by cutting a thick bamboo transversely below each joint, are placed closely together on the earthen bed after having been filled with finely-sifted rich soil. The seeds to be sown in them are soaked over night in water, and in the morning each seed is taken up and placed, by means of a pair of fine wooden forceps, on the surface of the earth, a few grains of fine sand or earth being sprinkled over it to prevent the seed being blown away; water is very sparingly given until the seed germinates. In about 60 days the seed germinates, and the young plant is left undisturbed until it is large enough to be planted out in the forest. Handling the young plant causes it to droop and decay, and I have frequently seen the young plants die after only touching the leaves on one occasion. Many of the seedlings perish in the earlier stages, often from unaccountable causes, and frequently from “damping off,” a term used by gardeners for decay caused by too much moisture and deficiency of light and air. Dr. Junghuhn recommends the removal of the lower pair of leaves from the plants when they are about six or nine months old, but I fear that doing so only tends to draw up and weaken the plants. When the seedlings are about a year or 18 months old, and have acquired a height of 12 inches, they are planted out in the forest in the sites which it is intended they shall permanently occupy. The planting is commenced at first in the immediate vicinity of the nursery, in cleared, well-dug circles about six feet in diameter. From the neighbourhood of these circles, brushwood and the overhanging trees are cleared away, so as to admit the light perpendicularly, while the side-lights are somewhat excluded. The plants are thus removed from any drip from the trees, while they have the full advantage of rain and a considerable amount of sunlight. The plants in the forest accordingly look healthier and hardier than do the seedlings grown under the dense shade of the thatched sheds. To protect the young plants from being broken by the falling limbs of trees, three strong posts are placed over them, being tied at the top over the plant so as to form a cone. Considerable damage was received at first from the partiality of *Cervus munjak*, a species of barking deer, for the tender shoots of the cinchona; but this danger is now avoided by a strong palisade of bamboo being placed round each circle until the tree has grown beyond the reach of this animal. After the ground near the nursery has been filled with plants, the circles are made along the footpath in the forest leading to the cinchona plantation and from it. Again, roads at right angles are cut through the forest, and these in their turn are planted. Thus, through time, the forest becomes intersected by footpaths cutting it almost into square patches filled with cinchona trees. After the trees are planted out, the only care they require is to be kept free from weeds and brushwood, to keep the paths clear, and to remove dead and overhanging branches from over the young trees. These operations, from the sowing to the planting out, and the tending of the trees afterwards, are all carried on in each plantation by the establishment attached to it. Thus, each nursery and its plantation are under the charge of a European gardener, who resides at the nursery, where also the little settlement for the native labourers is placed. Each nursery has been chosen with a view to there being several thousands of acres of forest available for the reception of the young plants, a method by which all expenses are diminished, while the important duties of supervision are efficiently discharged by the European overseer. In the forest the trees grow rapidly, the internodes of the stem elongate, and the leaves become much developed in size. The shutting out of the side-lights and nearly all the rays of the sun, except those from directly overhead, causes the plants to become drawn up and to grow rapidly in height: I do not consider this an unhealthy condition, as it is the state of the tree in its native forests as well as of all the trees of a tropical forest grown under the circumstances I have detailed. At the plantation at Tjiboddas, I observed plants of *Cinchona pahudiana* that had been only five or six years in the forest, and their height was about 25 or 30 feet, with a well-developed stem devoid of branches in its lower part, and with the leafy head (*coma* of botanical descriptions) stated to be characteristic of the cinchonas in their native localities. When the tree has acquired its full height, probably 60 or 70 feet, the trunk will become proportionally thick; for when it has reached its full stature, the crown of leaves, important organs of nutrition in all plants, will continue to perform their functions under the additional

tional stimulus they will receive from the strong light to which they will become exposed on attaining the average height of the other forest trees. Such also is the opinion of the Dutch gentleman in charge of the cultivation, with the important addition that they do not expect to obtain quinine in its full proportion until the trees have acquired their full development in thickness as well as stature. That will not be attained under 40 or 50 years in the case of *Cinchona Calisaya* and *C. Pahudiana*, and, probably, of *C. micrantha*, *C. nitida*, and *C. lancifolia*. *Cinchona Pahudiana* is the only species in Java that continues to bear seed, *C. Calisaya* having ceased to do so after the first occasion; some important observations have been made in regard to this process. Until very lately, the only plants that yielded seed were those in the fully-cleared ground of the Governor General's strawberry garden at Tjiboddas, on the slopes of the active volcano, Gedeh. These plants, from exposure to the sun and air, are mere leafy bushes, 10 or 15 feet in height, with a stem dividing at one or two feet from the ground into numerous branches, more in the manner of standard apple-trees than of the healthy young plants of the same species in the adjoining plantation in the forest, with their well-formed stems and definite head of leaves (*coma* of Weddell and other botanists). The first seed yielded by these plants was of excellent quality, affording a percentage of 60 or 70 seedlings. After the first year, the seeds began to degenerate, and out of a recent sowing of 20,000 seeds, only about 200 germinated. The plants are evidently all dying from the unnatural position in which they are placed. The good seed that is now obtained in Java is all the produce of a healthier plant of *Cinchona Pahudiana*, planted partially in full sunshine at the nursery of Tjineroen. It has begun to yield seed much too soon, for it has not yet acquired the half of its full height. The untoward effects of unnatural conditions in the seed has had greater influence on the more delicate species: *C. Calisaya*, a plant of it even more stunted and leafy than *C. Pahudiana*, has borne seed only once, though it continues to produce flowers abundantly. Both it and several plants of *C. Pahudiana* were covered with flowers, and the last also with seed, during my visit to Tjiboddas and Tjineroen; and I was allowed to take specimens from both species for the Royal Herbarium of Kew, as well as that of the Calcutta Botanic Gardens.

10. Observations made on many thousand plants of *Cinchona Pahudiana* and of *C. Calisaya*, show that the latter species requires a lower elevation, and therefore a higher temperature, for its successful cultivation than the former. At the plantation of Kawa Tjividii, 6,230 English feet above the sea, *C. Calisaya* grows much slower than it does at the plantation Reon Gœnong, 1,030 feet lower: these trees, of the same age as those at that plantation, are also much more vigorous, under the increase of nearly four degrees on the mean annual temperature of the upper plantation. Dr. Junghuhn finds that 5,300 feet ought to be the upper limit for *C. Calisaya*.

11. On my arrival in Java, Dr. DeVrij was engaged on some valuable researches on the alkaloids in the various parts of a plant of *C. Pahudiana*: these were discontinued, of course, while he was travelling with me, but they had advanced far enough for me to learn the general results. He had confirmed DeLondre's discovery, made about 20 years ago, that the roots of cinchonas contained a larger proportion of alkaloids than the bark. In the roots of a tree of *C. Pahudiana* only two years old, there was no wood with bark formed, but the herbaceous stem yielded nine-hundredths of a grain of quinine. These important discoveries induced Dr. DeVrij to propose to his Government that, instead of waiting until the trees are fully developed before attempting to procure quinine, an experiment should be made for the purpose of testing his discovery on a large scale. The result that Dr. DeVrij expects is, that quinine in considerable quantity would be obtained from the roots of trees about three or four years old: such a process would necessitate the destruction of the plants for the sake of their roots; the success would depend, besides, on there being several trees which bore seed abundantly, in order to keep up the supply.

12. In concluding this general account of what I observed in Java, I may state that I was greatly impressed with the advantage, in every way, of having so important an experiment directly under scientific superintendence. I particularly noticed that where the meteorology and botany with the general geology of the mountains were known, there was little difficulty in selecting the proper elevations for the various species of cinchona, and that, from a

knowledge of the habitats of the cinchona, there was no attempt made to grow them in such unnatural places for a shade-loving tree as cleared gardens, and at elevations either above or below their proper limits. If the experiment had all along been under scientific management, all the early errors which nearly threatened the extinction of the cinchonas in Java would have been avoided.

General Report on the Cultivation of the Species of Cinchona in the Neilgherries.

It is now more than 20 years since Dr. Royle recommended the introduction of the cinchona into India, and in 1852 he endeavoured to carry out his own suggestion by sending out to Calcutta seeds of *Cinchona Calisaya* procured for him by M. Weddell, who travelled in the cinchona forests of Bolivia from 1845 to 1847; these seeds were sown in the Botanic Gardens of Calcutta, but none of them germinated. In February 1853, Mr. Fortune, when on his way to China, brought six plants of *Cinchona Calisaya* from England by the overland route; these plants were sent to the Botanic Gardens of Calcutta, where one died soon after its arrival: the others were kept in the Botanic Gardens here for more than a year after their arrival, and were ultimately sent to Darjeeling, where they were planted in the open air, at a site considerably above what will prove to be the upper limit of this species in Sikkim. The introduction of the Peruvian-bark trees into India was also strongly recommended by Dr. Falconer, while he was superintendent of the Botanic Gardens here, in a paper published by the Agricultural and Horticultural Society. In 1855, I forwarded a communication on the same subject to the Medical Board. The assurance contained in these reports, that the cinchonas would succeed in India, induced the Government to recommend their introduction: the Court of Directors gave a favourable answer to the recommendation, but no steps were taken to carry out the experiment until after the mutiny.

2. In 1859 Mr. Markham, a clerk in the India Office, was appointed by Lord Stanley to proceed to South America, to procure plants and seeds of the best species of cinchona for transmission to India. As Mr. Markham's only qualification for this duty appeared to be a knowledge of the country where some of the cinchonas are found, acquired during travels in South America, his appointment was regarded with great surprise by scientific men; and Dr. Lindley, in the "Gardeners' Chronicle," predicted the entire failure which ultimately attended Mr. Markham's efforts, founding his opinion on Mr. Markham's ignorance of botany and science generally. A practical gardener accompanied Mr. Markham to South America. After an absence of nearly nine months, Mr. Markham arrived at Ootacamund with the remainder of 400 plants of *Cinchona Calisaya* originally shipped at the South American port. These plants were in Wardian cases, and had been brought from South America by one of the West Indian line of mail steamers to Southampton, where the cases were transhipped to the Peninsular and Oriental steamer for transport to Bombay. From Bombay Mr. Markham conveyed them by a special steamer to Calicut. On the 24th December 1860, all Mr. Markham's plants at Ootacamund were reported as dead. Simultaneously with Mr. Markham's expedition, arrangements were made to obtain seeds and plants of the valuable species *C. succirubra* through Mr. Spruce, the well-known botanist, who has now spent 12 years in South America as a botanical traveller and collector. Mr. Cross, a practical gardener, was sent out from England to assist Mr. Spruce, as well as to accompany the plants collected by them to their destination in India. The first result of their efforts was the dispatch to England and the West Indian Islands of a quantity of good seed of *C. succirubra*. Seeds of *Cinchona micrantha*, *C. nitida*, and *C. Peruviana*, sent from Huánaco by Mr. Pritchett, an agent engaged by Mr. Markham, arrived at the Royal Gardens at Kew about the same time as those sent by Mr. Spruce. Sir W. Hooker entrusted packets of all these species to my care, for sowing in the Botanic Gardens, Calcutta, and for distribution to the Botanic Garden at Ceylon, and to the gardens at Ootacamund. The seeds sown at these places germinated well. A large quantity of the seeds of the four species of cinchona were also sown at Kew, in the propagating-house built expressly for them by the orders of the Secretary of State for India. In January 1861, I brought out with me from England two plants of *Cinchona Calisaya*, for the cinchona nursery at Ceylon. These arrived in perfect health, and have been extensively propagated. The gardener Cross arrived at Ootacamund on the 9th April 1861, with 463 plants of
Cinchona

Cinchona succirubra procured by Mr. Spruce and himself. These plants were brought by the same route as Mr. Markham adopted, viz., mail steamer from Chagres to Southampton, and the Peninsular and Oriental Company's steamer *vid* Southampton to Bombay, and then steamer to Calicut. Mr. Cross had with him six plants of *Cinchona Calisaya*, propagated in England from old plants which had existed for several years in England as curiosities, and which had been added to his stock at Southampton. All his plants, although they had been six months in Wardian cases, were in such excellent health that Mr. McIvor was soon able to propagate them artificially to such a degree, that from 507 plants of *C. succirubra*, the stock on the 9th May 1861 (463 of which were brought by Mr. Cross), there were on the 1st January 1862, 5,200 plants. From my own experience of the difficulties attending the transporting of so delicate plants by long sea-voyages, and especially of the trying journey in the Red Sea, I am certain that Mr. Cross deserves a large share of credit for the great success that has so far attended our efforts to introduce the cinchonas.

The plants of *C. Calisaya*, *C. lancifolia*, and *C. Pahudiana*, brought by me from Java, are the last addition to the number of species and plants of cinchona in India.

3. *General Condition of the Experiment in the Neilgherries.*—The introduction of the cinchonas into India is still in the first stage. With the exception of a few plants recently placed in the open-air nurseries at Neddiwattum, all the cinchona plants in the Neilgherries are growing in the conservatories in the Government Gardens at Ootacamund, where, protected from the vicissitudes of the weather, and in a recently erected house, even under the influence of artificial heat, they are growing luxuriantly. Under such favourable circumstances, the plants receive at once every condition necessary to their perfect health that an almost hourly observation of their wants indicates. They have been placed under these circumstances for two reasons:—In the first instance, from there being no one in the Neilgherries who could point out the sites on those mountains best adapted for receiving the plants; and thus they were considered to be safer under the protection of a glass-house, and now they are retained there in order to be artificially propagated to the greatest possible extent. The great success that has followed, and the result, compared with the early efforts of the Dutch, show that this is the wisest plan that could have been adopted. The 463 plants of *Cinchona succirubra* brought by Mr. Cross in April 1861, with the plants of this species raised from seed, had been multiplied on the 31st December to 5,200, and his six *C. calisayas* to 11, not one of Mr. Markham's having survived. It is hardly necessary to extend this report by referring to the minutiae of Mr. McIvor's method of propagating the plants, beyond stating generally that each plant, as soon as it has attained a sufficient size, is artificially propagated by being "layered." In the recently erected propagating-house, where artificial heat can be applied to the soil by flues passing under the beds of earth, this process of layering will be carried on at double the rate, as the layers can then be removed from the stock plant as soon as the smallest roots appear; and on being placed in the heated soil these roots grow rapidly, and the newly-formed plant is in its turn ready to be increased from every internode. In this branch of the cultivation, Mr. McIvor has brought all the varied resources of highly advanced English gardening to promote the object he has in view—the obtaining the largest number of plants in the shortest possible time.

4. *Of the Sites for the Cinchona Plantations in the Neilgherries.*—As regards experiments or observations on the suitable localities of the Neilgherries for the cultivation of cinchona, we are as far from possessing them now as before the introduction of cinchona at all. I maintain that the successful rearing of the cinchonas in the greenhouses at Ootacamund is no more a proof that the climate of the Neilgherries is adapted for their cultivation, than the fact that many thousands of seedlings, as well as cuttings, are now existing in perfect health in the cinchona nursery at Kew, would lead us to expect that the plants will grow in the open air in England. The great difference that exists between the climates of the South American cinchona forests and the Neilgherries ought to have received greater attention than it has; and in the selecting of sites, convenience of access from Ootacamund should have been made subservient to the greater consideration of climate. A few sites have been chosen on the Neilgherries for the permanent plantations of the cinchonas, but none of them answer to the accounts

given of the cinchona forests of South America, nor to those in which the cinchonas succeed in Java. A few remarks on the physical aspect, climate, and botany of the Neilgherries will allow of a comparison being made with the account I have already given of Java, and also with the brief notice I shall add of the physical features of the forests of the Andes.

5. *Of the physical Aspect of the Neilgherries.*—The elevated plateau of the Neilgherries has its central point in about north latitude 11 deg. 30 min.; its greatest breadth is nearly 50 miles from the north-east to south-west, while in another direction the breadth diminishes to 20 miles. The lowest point of the plateau, where its steep escarpment running down to the plains commences, is about 6,000 feet. Its surface is diversified by rounded grassy hills and flat-bottomed valleys, the result of denudation by marine action. The loftiest of these hills is Dodabetta, about 8,700 feet above the level of the sea, and situated close to the station of Ootacamund. The bare unwooded hills and valleys, with trees only in the ravines and very sheltered spots, give a bleak and uninviting aspect to the upper region of these hills. The sides of the hills running up to the crest of the plateau are more or less wooded throughout, but the botanical character of the forests and the size of the trees vary much on the different aspects of the escarpment, the contrast being greatest between the northern and southern slopes.

6. *Geological Structure of the Neilgherries.*—(See Memoirs of the Geological Survey of India, vol. i. part 2.)

The rocks of the Neilgherries consist of the varieties of gneissose rocks, composed principally of quartz, hornblende, felspar, and garnet. A few dykes of trap occur in some parts. A good fertile but rather shallow soil, in many parts very stony, is formed by the disintegration of these rocks. The best soil is formed in the deeper ravines that have been long covered by trees, and where the decayed vegetable matter forms a stratum of some depth; I frequently noticed good soil of great depth on the less abrupt slopes on the north-western and western sides of the plateau.

7. *Meteorology of the Neilgherries.*—I have been able to find no very trustworthy observations on the temperature of any of the stations on the Neilgherries, and none of the hygrometric state of the atmosphere. Mr. McIvor spoke to me of the density of the atmosphere, but I fear that he must have misapplied the term, as barometric records, the index of the density of the air, are not of the slightest value with reference to vegetation, except when they are made for the purpose of determining the altitudes of mountains. The climate of the Neilgherries partakes of the nature of that of the plains by which it is surrounded. Of these, the Carnatic on the east receives the shortest and irregular north-east monsoon in November and December, the Neilgherries receiving a few passing showers in some parts, the north-eastern slopes receiving more than those further removed, while in some portions rain scarcely falls at all during this monsoon. The greater portion of December and the whole of the months of January, February, March, and April are very dry. In May, only a few showers occur, and now and then there is a day of heavy rain. The rainfall at Ootacamund from the 1st November to the end of May, from the average of seven years' observation, amounts to only 14 inches. Small as this amount is, in order to prevent errors, it is necessary to state that during seven years, only one inch of rain fell in December, while not a drop was recorded for the three following months. During this period irrigation is absolutely necessary in the coffee plantations, especially on the eastern aspect of the hills, and even in the Wynaad on the moist side. The south-west monsoon, commencing in June, blows with great violence along the western coast of India, and extends to the western slopes of the Neilgherries and to the Koondahs. Its greatest force is spent on the western crest of the plateau and the hills rising from it, so that comparatively little rain occurs towards the centre of the table-land, though the atmosphere is very moist. Hardly any rain passes over the Neilgherries to the Carnatic. During the remaining five months of the year, about 22 inches of rain fall, making up almost 48 inches on an average of seven years' observation at Ootacamund. We have thus the climate of the Neilgherries, as regards rainfall and moisture in the atmosphere, divided into two periods: a long one of comparative drought with 13 inches of rain occurring in its two last months, with one inch distributed over the other four; second, a period shorter than the previous one, during

during which rain falls with comparative regularity and abundance during five months, to the amount of 22 inches at Ootacamund. The temperature of the Neilgherries, like that of all hilly countries, varies from mere local causes. In a low marshy valley on a clear night in December or January, when radiation is excessive, I have seen the thermometer sink even to 24 Fahr., while a self-registering minimum thermometer which I had placed on the Dodabett Hill, nearly 1,000 feet higher, and partly shaded by trees, recorded only 31 degrees. These cold nights are followed by days of comparatively great heat, the thermometer rising to 60 and 61 degrees, giving a range of 37 degrees for the lower localities, and almost 28 degrees for the higher and drier ones. Through the clear atmosphere which exists at this dry season, the sun shines with great power; so great, that on one occasion my black bulb thermometer, placed in the full sunshine, at 11 a.m., rose to 177 degrees. The dryness of the air during these seven months is also very great, my hygrometers (dry and wet bulb thermometers) indicated 11 deg. 9 min. as the dew point. Records of the temperature and rain-fall at Ootacamund observed during a series of years are published in Mr. Smoult's edition of Dr. Baikie's Memoir on the Neilgherries. These tables give a maximum temperature of 76 degrees, a minimum of 31 degrees, and a mean annual temperature of 56 deg. 5 min. The conclusion from these data is that Ootacamund possesses a very equable climate. The locality where these observations were made must have been one of the most favourable in Ootacamund, as I recorded much lower temperatures than any observed either by Dr. Baikie or Mr. Ross, and that too without my having chosen the coldest spot in Ootacamund. During the short time I remained in Ootacamund, I was able to make a very few observations on the temperature and humidity of the air, and those I succeeded in obtaining were most carefully made with good instruments. The instruments I had with me were two good self-registering minimum thermometers, an excellent thermometer by Greiner of Berlin, and a very delicate one by Newman, and a second less delicate one by the same well-known maker. I also used a mountain thermometer by Newman, graduated to fifths of a degree. This I used as a black bulb thermometer. My hygrometer was constructed from a thermometer by Greiner, and another by Newman.

METEOROLOGICAL OBSERVATIONS AT OOTACAMUND.

Minimum Temperature on Grass at Ootacamund.		Of the Air at 7 A.M.	Of the Air at 10 A.M.	Of the Air at 2 P.M.	Of the Air at 6 P.M.	Of the Air at 10 P.M.	Humidity of the Air from Three Observations.
22 December 1861	16° Fahr. - - -	34°	53°·5	60°·3	47°	33°·5	0°·668
23 December "	{ Minimum 3 feet above the ground, 24° Fahr. - }	- -	- -	59	- -	28	—
24 December "	{ Minimum 3 feet above the ground, 14° Fahr. }	26	—	—	—	—	—

On the night of the 24th December:—*Eucalypti*, a few acacias from Australia, roses, geraniums, fuchsias, and many other soft-wooded garden plants, were destroyed; besides several indigenous shrubs, such as *Berberis Nepalensis* and *Aristata* and *Lobelia excelsa*, were blackened by the frost. At an elevation 600 feet higher than the compound, where the above observations were made, the air felt drier and warmer, and this was confirmed by the thermometer, which at noon stood at 60 deg., while the humidity of the atmosphere was only 0·417, or nearly absolutely dry.

8. This short sketch of the climate of the Neilgherries is applicable to all the central portions of these hills. The slopes present considerable differences, according to their exposure; but their climates vary only in the quantity of rain that falls during the monsoon. Thus while Ootacamund receives only 48 inches of rain (or 63 inches according to some) in the year, and the average rain-fall over the Neilgherries is about 90 inches, the Koondahs, which receive the full force of the south-west monsoon, are stated to have a rain-fall of 250 inches. All, however, possess the marked dry season of the year. This dryness of the

air and soil would not exist if the Neilgherries were more elevated. Mountains covered with perpetual snow have constant sources of moisture from the amount of evaporation given off by the snow as well as from the perennial streams that have their origin in the melting snow.

9. *Botany of the Neilgherries.*—The vegetation of the Neilgherries wants greatly the luxuriant character of the temperate forests of the Himalaya. The trees above the crest of the plateau accordingly partake more of the character of brushwood than forest. The trees existing in the “sholas” and filling up the ravines are rather scattered; they are generally slow-growing species, and apparently of great age. Their trunks are short, much branched and gnarled; most of them are evergreens, with hard leathery smooth shining leaves, adapted for withstanding a dry cold climate, where extremes of heat and cold are found. With them, and forming the undergrowth, there occur annuals springing up at the commencement of the rains, flowering soon, and fruiting before the dry weather commences. With these annuals, plants with perennial roots and rapid growing succulent stems are mingled. In the warmer forests, such as those below the western and north-western crests of the plateau, the forest after November is almost impenetrable, from the intricate way in which those dried-up stems of these plants are entwined. This state of rest indicates an absence of that important character of the South American cinchona forests mentioned by most travellers, and also by Mr. Markham—continuous vegetation. The period of rest which occurs in the vegetation of the Neilgherries is entirely owing to the long continued drought. It does not occur in South America nor in Java, because these countries possess a perpetually humid climate, and it exists only slightly in the moist sub-tropical forests of Sikkim. The common trees of the Neilgherries sholas are *Michelia Nilagirica*, *Myristica Malabarica* (in forests up to 5,500 feet), *Cleyera*, *Gymnanthera* and *Gordonia obtusa*, *Stemonurus fœtidus*; one or two species of *Microtropis*, *Photinia Notoniana*; two species of *Eugenia* and *Cinnamomum*. The brushwood consists of a few *Aralias*, *Turpinia Nepalensis*, *Berberis Nepalensis*, and *B. aristata* *Celastrineæ* and *Rhamnaceæ*, *Pittosporum tetraspermum*, *Leguminosæ*; one or two *Melastomaceæ*, *Rubiaceæ*, belonging to the genera *Wendlandia*, *Canthium*, *Lasianthus*, *Coffea*, *Grumelia*, *Psychotria*. A few large *Vernoniæ* are also frequent; *Acanthaceæ* have gregarious species, such as *Phellobhyllum*, *Stenosiphonium Russellianum*; several species of *Strobilanthus*, principally of the old section, *Endopogon*; *Barleria*, and several species of *Thunbergia*, all climbers. The large *Lobelia excelsa* is very abundant everywhere. Two species of *Vaccinia* and one of *Gaultheria* are rather common shrubs. The gnarled trunks of *Rhododendron arboreum* distinguish it as one of the slowest growing of the Neilgherry trees. In warmer woods, a species of *Calamus* is common, and with it tree ferns of no great size occur, but only in the moistest hollows. A few epiphytic orchids are common on the branches of trees in the less elevated forests below the crest of the range. Among the species I observed at Neddiwattum were *Pholidota bimricata*, a little *Bolbophyllum*, a species of *Trias*, *Eria Dalzellii*, *Dendrobium Microchilon*, with *Eria Mysorensis* in the lower parts. A strange pellate-bulbed *Dendrobium*, *D. Microbullon* was rather common, closely adpressed to the bark of the trees. The large luxuriant sections of *Dendrobium*, *Cymbidium* and *Vandas*, as well as the large perennial terrestrial orchids of the moist Java forests, are entirely absent. Hygroscopic ferns, Lycopodia and mosses, indicatives of the dry and wet seasons of these mountains, covered the branches of the trees. At the season I was there they were dried and shrivelled up in all the forests I visited, except where they were moistened by the spray of small cascades. *Tremantodon Schmidii cuneifolius*, *Dicranum albescens* and *densum*; *Tortula Orthodonta*, *Fumaria connivens*; one or two species of *Philonotis*, *Neckera flabellata*, *Æqualifolia Arcuans*, and *parvula*; also a moss, detected by Mr. M'Ivor, *Stereodon Ivoreanus*, are those occurring among a host of other species.

10. Any sites for the permanent cinchona plantations in such a country want, therefore, that important condition of a perpetually moist climate all the year round. With the exception of one, the sites that have been chosen are certainly the most favourable localities that could be found in the Neilgherries. The Dodabetta site seems to me to be very unsuitable, and this opinion, based first on the printed reports of Mr. Markham, Dr. M'Pherson, and Mr. M'Ivor, was quite confirmed when I visited it. Its elevation is too great for any species but

C. lancifolia

C. lancifolia and *C. micrantha*, and for them I consider it too dry. It is situated behind and joins on to the Government gardens, and extends from 7,830 feet to 7,950 feet above the sea; it is of small extent, containing only about 50 acres, and some acres must be deducted from this in computing the available ground on account of the rock cropping out through the soil as well as the steep declivities of some parts. Mr. M'Ivor, who seems to have chosen this locality, and who has recommended Government to spend a considerable sum of money in cutting down the bushes and making footpaths through the wood, has evidently formed a very erroneous idea of its climate. Thus Mr. M'Ivor informed me that the rain-fall was 80 inches, which must be an error, as not half a mile off 48 inches are given by Dr. Baikie and Mr. Ross as the rain-fall, while 63 inches is the maximum I can find for Ootacamund, and that probably refers to the summit of Dodabetta, where the observatory was placed. Mr. M'Ivor showed me a spot in this ravine where he told me that I would find the climate "perfectly moist," and that it was the dampest part of the shola, and so it also seemed to me to be, but my hygrometer indicated 15 degrees between the wet and dry bulbs, or a humidity of only 0.417, saturation being indicated by 1.000. During nearly every day in December and January the thermometer must fall to nearly the freezing point, for at the place indicated by Mr. M'Ivor as the warmest and moistest in the site, my minimum fell on the night of the 23d December to 31 degrees, and there were many colder nights than this even during my short stay in the Neilgherries. I found nearly all the residents of Ootacamund judging of frost merely by the presence of hoar frost. The existence of hoar frost of course is ample proof that the thermometer has at least reached the freezing point, but as hoar frost is merely frozen dew depending on the presence of moisture in the air, its absence does not show that a low degree of cold has not occurred. Accordingly, where my thermometer indicated 31 degrees there was no hoar frost, although the thermometer was one degree below the point at which hoar frost is formed. The humidity of the air at 7 a.m. on the 23d in this shola was only 0.747. It is much to be regretted that no observations of any value were made in this ravine before choosing it as a site for cultivating cinchonas; it seems to have been chosen during the rainy season when the climate all over the hills is moist. I visited the Neddiwattum site a few days after my arrival at Ootacamund, and I spent three days at the Neddiwattum bungalow, for the purpose of examining the site more leisurely. I made a series of observations on the temperature and humidity of the air which show only such differences between those made at Ootacamund as are the result of the lower elevation. This forest is of considerable extent, stretching from the crest of the plateau at 5,800 feet to much below the open cinchona nursery in the centre of the forest, about 4,500 feet elevation. Some of the trees are of considerable size, though the majority are small both in height and thickness of stem; and I saw almost none above 70 feet in height. *Sterculia guttata*, *Michelia Nilagirica* and *Myristica Malabarica* were among the loftiest I observed. The vegetation generally presented very markedly the usual characteristics of a region where the year is divided into a wet and a dry season. The forest was choked up by dried remains of the vigorous vegetation of the past rainy season, consisting principally of *Strobilanthes viscosus*, *lupulinus*, *Heyneanus* and allied species of *Acanthaceæ*. The mosses and most of the ferns were dried up, and in a state of rest. The days were clear with bright powerful sunshine, and the atmosphere very dry; the nights were cloudless, and from the great radiation, the cold towards morning was always very intense; the thermometer, above 6,000 feet, falling generally to the freezing part in open spots. The thick banks of mist which collected every night over the Wynaad coffee plantations never ascended above 2,500 feet, and in the morning they were dissipated by the powerful rays of the sun.

11. Of the climate at the other periods of the year I could only judge by the reports from the residents in the hills. All agreed in one statement, that the climate becomes excessively dry in February, March, and April, and that comparatively no rain falls for five or six months, while during the four months from the beginning of June until the end of September, the moisture is abundant. At this site above 50 acres of forest have been cleared from trees, and it is further intended to trench this extent of land with the view of preparing it for a plantation of cinchona without shade. Such a procedure is quite opposed

to all we know of the habits of the genus, as well as the opinion of so great an authority as Weddell, as well as the experience of the Dutch in Java. Until we know that the cinchonas will succeed in the Neilgherries under conditions as similar as possible to those in which they are found in South America, such a proposed mode of cultivation as I have alluded to above, seems to me to be very premature. Neither will there be any medium between perfect success and complete failure, and all the probabilities point to the latter result as the most probable.

12. The following few, but very carefully made meteorological observations, were noted during my visit to the Neddiwattum site:—

25th December.—Temperature of air at the Neddiwattum Cinchona Nursery at 1.30 p. m., 60 deg. 5 min.; at 6 p. m. 53. of soil in shade, and three inches below surface, 55; humidity of the air at 1.30 p. m. 0.632. At Neddiwattum Bungalow, at 5,800 feet elevation, the temperature of air at 8 p. m., 53 deg.

26th December.—At the Bungalow at 6 a. m., 34 deg. 5 min. In sheltered spot under trees at 7 a. m., 40 deg.; at the open Nursery a minimum thermometer exposed all night, 39 deg.; at 7.30 a. m. in open air, 41 deg.; under trees, 50 deg.; temperature of air at Bungalow at 11 a. m., 61 deg.; humidity of the air at Bungalow at 11 a. m., 0.596; humidity of air close to a stream in the forest adjoining the Bungalow, noon, 0.708; temperature of air at Bungalow at 10.30 p. m., 47 deg. 5 min.

27th December.—Temperature of air at Bungalow at 6 a. m., 35 deg.; at the cinchona nursery by minimum, 42 deg. Greatest daily variation observed at the nursery, 21 deg. 5 min.

13. Arguing from these observations, the open cinchona nurseries at nearly 5,000 feet are too high for *Cinchona succirubra*, but as regards temperature they are very suitable for *Cinchona Calisaya*, *C. nitida*, and perhaps *C. Peruviana*, and probably one or two degrees too warm for *C. micrantha* and *C. lancifolia*. The other site was at the Avalanche Bungalow, but as no planting will be commenced there for some years, it is quite unnecessary to enter into details concerning it. The result of my personal observation, as well as of my inquiries, satisfied me that there is an abundance of localities of the above character obtainable in the Neilgherries for the cultivation of the less temperate species of cinchona, such as *C. succirubra*, *C. Calisaya* and probably *C. nitida* and *Peruviana*, as well as *C. Pahudiana*. For the temperate species, of which we now possess *C. micrantha* and *C. lancifolia*, and among which *C. Peruviana* may require to be classed, the higher portions of the Neilgherries, though cold enough, are too deficient in moisture and continuous forest to allow of their being successfully cultivated. For such temperate species, that will almost withstand a slight fall of snow, we must look for a proper home in the moist region of Darjeeling, and the damp deep inner valleys of eastern Kumaon. Fortunately, the largest number of plants in the Neilgherries belong to that very valuable species, *C. succirubra*, and it is that species which I am certain that from necessity, as well as choice, Mr. M'Ivor will be obliged to cultivate most extensively. The following short extracts, taken from well-known writers on the subject of cinchona, and from the reports of Messrs. Markham, Spruce, and Pritchett, will show the climatological requirements of each species:—

14. *Cinchona succirubra*, a native of the equatorial portions of the Andes, near Mount Chimborazo, from the line to two degrees south latitude. Mr. Spruce, who visited the forests on more than one occasion, says that the tree is found at the base of the mountain, and that some of the lands formerly occupied by this species are now cleared for the cultivation of sugar-cane. His observations show it to be the most tropical of all the species of quinine-bearing cinchonas. The climate, as described by Mr. Spruce, is exceedingly moist; even in July, one of the dry months, there was "a great deal of mist and fog;" rudimentary lichens formed on the seed capsules of *C. succirubra*, a striking proof of the humidity of the weather. The elevation of the forest is 3,000 feet above the sea, and the mean temperature from the 19th June until the 27th September, is a small decimal less than 68 deg. The minimum temperature observed was 59 deg. 32 min., and the maximum 80 deg. 5 min. The temperature of the earth at two feet under the ground, 68 deg. 5 min. During the period of these observations the

sun

sun is north of the line, so that probably the summer is two degrees warmer, which would raise the mean annual temperature to nearly 70 degrees. In a letter to Sir W. Hooker, dated the 20th October 1859, Mr. Spruce has entered fully into the botany of the forests of the western slopes of the Quitenian Andes, where *C. succirubra* is found, so that I am enabled to form an opinion of the character of the flora existing along with *C. succirubra*. He says, "The Cascarilla roja (the Spanish name of *C. succirubra*) seems to grow best on stony declivities, where there is, however, a good depth of humus, and at an altitude of from 3,000 to 5,000 feet above the sea. The temperature is very much that of a summer day in London,* though towards evening each day cold mists blow down the valley from Azuay, and for five months in the year, from January to May, there is almost unceasing rain. To prove further the tropical character of *C. succirubra*, several species of palm are found along with it. These are, two species of *Phytelephus*, or irony palm, a species of *Carludovica*, a species common on the Amazon; *Triplaris Surinamensis* was also very abundant. "In general, the arborescent vegetation seemed scanty in species and uninteresting. There were also a few figs, and on the steep declivities there were patches of low forest, consisting chiefly of *Clusiæ*, *Thibawdiæ*, and *Melastomaceæ*. Two small *Trichomanes* crept along the branches of shrubs, but terrestrial ferns were all but absent."

From what I have observed of this species both in the Royal Gardens at Kew, where the seeds germinate in the propagating house with a temperature of 78 deg. for the day, and 10 or 12 degrees colder by night, from the fact that none of the seedlings of this species raised in Calcutta last March, have suffered in the least degree, and from the temperature of the glass houses at Ootacamund, in which the species succeeds admirably, ranging from 55 deg. at night to 78 and 80 deg. for the maxima, I am convinced that *C. succirubra* is a very tropical species. The nurseries at the Neddiwattum site are therefore too high, as they are situated at what will prove to be the upper limit of the successful cultivation of this plant, and the patches of forests cleared for the young plants are still 500 feet higher. Mr. Milver has placed out in the Government garden at Ootacamund some plants of this species; when I saw them they were sickly, from being at least 2,500 feet above their highest limit.

15. *C. Calisaya* is a lofty tree of considerable thickness of stem common in the forests of Bolivia and Caravaya. Weddell says it grows in the hottest forests of Caravaya and Bolivia at an elevation of 5,000 to 6,000 feet above the sea. His account of its habit shows that it is a shade-loving tree, and he believes that the shrubby variety *C. Calisaya* var. *Josephiana*, is merely the result of the exposure of some plants to the influence of bright sun-light. His remarks on this subject are worth translating, especially as Mr. Markham in his extracts from Weddell's book has omitted them. He says—"I have for long thought that this variety might constitute a distinct species, but a more attentive and complete study in its native place has convinced me that it is nothing but a peculiar form of the type *C. Calisaya*, to which I have referred it. I have at the same time little doubt but that the districts which it now occupies were formerly covered with forest, and which having been destroyed, doubtless by conflagration, this plant has assumed a shrubby form, resembling in this many other plants of Brazil, which may be observed having a different proportion, according as they exist in the plains or the forest. Accordingly, it is probable that the cultivation of quinine trees will not succeed unless we apply to them the conditions necessary for the plants to raise themselves. It will be necessary always for this reason that they should have the society of other trees growing a little more rapidly than themselves, in order to afford a salutary shade during the first years of their existence." See Weddell's *Histoire Naturelle des Quinquinas*, p. 32.

Mr. Markham, in his report, is not very explicit in his remarks about the climate of the *Cinchona Calisaya* districts. A spot where this species grew abundantly was 5,422 feet above the sea, and at a nearly similar height the lowest temperature observed was 53 degrees and the highest 67 degrees. This was in May, corresponding in season to our month of November, and at five degrees

* Mean temperature of a day in July in London is about 68 or 70 degrees.

degrees further from the equator than Ootacamund. Even Neddiwattum, only 5,000 feet, is far too cold even for this species, and probably much too dry, according to the data of the climate of the Caravayan forests furnished by Mr. Markham, who states that the rains last for nine months.

16. I have a number of statements concerning the cinchona forests of South America, all of which describe the abundant moisture the trees delight in. It would extend this report too much to classify them under the various species we have under cultivation. To cite two of them, Weddell says of *C. micrantha*—"It grows in the shady moist woods of the mountain;" and again, "of all the cinchonas which I have studied in the living state, *C. micrantha* is the one which delights most in humid places. In the provinces of Carabaya I have met with it close to torrents. Under these circumstances, the leaves acquire a larger development there than they do in drier places."

17. Of *Cinchona lancifolia*, the same author says—"According to Humboldt, *C. lancifolia* extends high up the mountains; the upper limit of its zone is below 9,500 feet. The individuals which grow at this elevation are exposed during the cold nights to a temperature near 32° Fahrenheit." Karsten, writing generally of the best species of cinchona, says—"The scrobiculate-leaved cinchona, rich in alkaloids, inhabits the misty region of the Andes, where, in the nine months' rainy season, the constant rain is only interrupted in the day by interchanging sun rays and fog clouds; whilst in the season corresponding with winter, cold nights, in which the temperature sinks, and the dark azure sky is lighted by the glittering brilliancy of innumerable stars, follow days in which the rays of the sun, warming the atmosphere to 76 degrees, now and then penetrate the thick fog which lies almost constantly on the damp foliage of the forest. The average temperature of this region is from 53 degrees to 55 degrees Fahrenheit."

"The less healing, generally large-leaved, unscrobiculate cinchona, occupying a more extensive district, and living in some measure in common with the *Ladenbergia* genus, is more rarely refreshed by falling showers and rising fogs in the dry season, when it has to bear a temperature rising to 96 degrees, whilst in winter it falls to 40 degrees of heat in the morning, and rain generally follows the sunny morning hours, from midday to midnight only."

The cinchona,* with the small fruit, scrobiculate leaves, and rich in alkaloids, is confined to 11 degrees north and south of the centre point of the district of Loxa. It descends only to a height of 6,500 feet above the sea, from the cold summits of the mostly snow-capped mountains, where it sometimes reaches the upper limits of the growth of trees, i.e. 11,500 English feet.

18. Mr. Pritchett, referring to the forests of Huanaco, where *Cinchona nitida*, *C. micrantha*, and *C. Peruviana* are found, says—"On the forest side the vapour and cloud are continually bathing the woods, which seem at this spot to be the perpetual focus for the converging clouds. At one time, a raging tempest of rain and wind; at another, the calm, tranquil, leaden atmosphere of chilling cloud and fog."

"Although it was then about the middle of the dry season, heavy soaking rains were still falling from day to day. Towards the latter part of July the weather broke up, and the sun began to make impression on the solid banks of clouds that filled the valleys. Though clouds were the prevalent visitants during this so-called dry season, there were occasions during some portions of the day when the sun unveiled, and even penetrated to the very underwood of the forest. But even to the last day of my remaining here, when we had nearly a fortnight's fine weather, with only an occasional shower, the tracks were still deep with mud, and only in the exposed situations could the mud be found less than ankle-deep." "The climate of these districts is essentially moist and warm."

19. I am indebted to Mr. M'Ivor for the following tabular statement of the number of species and plants of cinchona in the Neilgherries on the 31st December 1861:—

REPORT

* *C. micrantha*, Ring et Paron.

REPORT on the Number and Condition of the Cinchona Plants in the Government Gardens at Ootacamund and Neddiwuttum on the 31st December 1861.

NAMES.	Number of Plants.	Value per lb. of dry bark in the London market.
1. Cinchona succirubra - - - - -	5,200	s. d. 2 6 to 8 9
2. Cinchona Calisaya - - - - -	59	2 10 to 5 0
3. Cinchona lancifolia - - - - -	4	1 8 to 2 10
4. Cinchona nitida - - - - -	1,050	1 8 to 2 9
5. Cinchona sp. without name - - - - -	314	1 8 to 2 10
6. Cinchona micrantha - - - - -	1,497	1 8 to 2 9
7. Cinchona Peruviana - - - - -	64	1 8 to 2 10
8. Cinchona Pahudiana of Howard - - - - -	425	No value.
TOTAL Number of Plants - - - - -	8,613	

(signed) W. M'Ivor.

The plants brought by me from Ootacamund require to be deducted from this statement to give the actual number of plants that were in the Neilgherries when I left on 4th January.

20. The following statement gives the number of cinchona plants in the Botanic Gardens, Calcutta, on the 1st February, arranged according to the species and under sources whence I obtained them. The plants are in very good health, and *Cinchona succirubra*, *C. Calisaya* and *C. Pahudiana* are growing most vigorously, and seeds *C. Pahudiana* are coming up daily :—

TABLE showing the Number of each Species of Cinchona in the Botanic Gardens, Calcutta, on the 19th January 1862.

Name of Species.	From Ootacamund.	Raised in Botanic Gardens, Calcutta.	From Java.	Total.
<i>C. succirubra</i> , Pav. - - -	87	4	- - -	91
<i>C. Calisaya</i> , Wedd. - - -	- - -	- - -	6	6
<i>C. nitida</i> , R. et P. - - -	56	11	- - -	67
<i>C. micrantha</i> , R. et P. - - -	43	13	- - -	56
<i>C. Peruviana</i> , Howd. - - -	4	1	- - -	5
<i>C. Pahudiana</i> , Howd. - - -	- - -	- - -	59	59
<i>C. sp.</i> Ignot - - -	3	2	- - -	5
	193	31	65	
GRAND TOTAL of Plants of Cinchona in the Botanic Gardens, Calcutta - -				289

21. I would recommend the following plan as the best that could be pursued with the view of introducing the cinchona into the mountain ranges of the Bengal Presidency.

By my possessing plants of all the species of cinchona that have as yet been introduced into India and Java, the experiment is in reality a year in advance of the time when I obtained permission to commence the cultivation in the Khasia hills. I then intended to commence operations with only *Cinchona Calisaya*, *C. succirubra* and *C. Pahudiana*, of all of which I had specimens, and I had then no hope of obtaining the large supply of the other three species which I have since then received. If I should have obtained these additional species next year, I would then have recommended the extension of the cultivation to the Darjeeling ranges. This I consider must be done this year, in preference to commencing in the Khasia hills, where sites for the temperate species cannot be found. I would therefore request permission, under the orders of the Government of India, to proceed with all the cinchona plants to Darjeeling, immediately after the expiration of my duties as professor of botany and examiner in medicine in the middle of March. It will be necessary to secure the services of a European gardener or

overseer, to remain in charge of the cinchona nursery at Darjeeling, and to act under my orders. I would instruct such a person in all the details of propagating, as practised so successfully by Mr. M'Ivor, and also in such parts of the Dutch system as seem to me worthy of imitation. I should further commence at once to prepare to test the value of Dr. DeVrij's suggestion, by allowing a sufficient number of seedlings of *C. Pahudiana* to grow rapidly in a warm site, with the intention of destroying them after three years for the sake of their roots. This I shall be able to do as I possess about 400,000 seeds of *C. Pahudiana*. One of my first steps at Darjeeling would be to obtain at least 1,000 acres of suitable land on the lower and outer ranges of Darjeeling. After selecting such a spot, a house would require to be built for the accommodation of the European gardener, also a propagating house after the model of the last one built at Ootacamund, expressly for the propagation of cinchona, a plan of which I possess, also a hut for two or three native gardeners from the Botanic Gardens, Calcutta. If such a plan should be sanctioned, I can safely promise that after 12 months there will be cinchona plants enough in Darjeeling to commence a nursery for the more tropical species in the Khasia hills, besides supplying the Dutch next November with the plants promised to them. With the assistance of a propagating house, *Cinchona succirubra* will be increased in 10 months by 500 per cent., while without such aid, perhaps an increase of only 20 per cent. will be the result. The larger the scale on which this cultivation is commenced, the greater will be the return, and the sooner the yield of quinine. The aim ought to be to throw the greatest quantity of quinine into use in the shortest space of time possible. This can only be effected by taking full advantage of the high state of perfection to which English gardeners have carried artificial propagation until we possess seed-bearing trees, and by the scientific superintendence of the whole experiment, and most especially of the selection of sites for each species. If this plan is sanctioned, I would solicit that the following estimate of the probable expenditure for the next year be favourably considered, and further that I may be allowed to engage the services of a European gardener without delay. For such a person a salary of 150 rupees a month, and a dwelling house (or an equivalent until a house could be built,) would be sufficient for the first year, but to secure a good and trustworthy man, it will be necessary to promise an increase to 200 rupees a month after the first year:—

APPROXIMATE ESTIMATE for the Expenditure of the proposed Cinchona Plantation in the Bengal Presidency for the Year commencing 1st April 1862.

	Rs.	a.	p.
Salary of one European gardener at 150 rupees per mensem -	1,800	-	-
Two native gardeners at 14 and 12 rupees each per mensem -	312	-	-
15 coolies at 5 rupees each per mensem - - - -	900	-	-
My travelling expenses to and from Darjeeling - - -	500	-	-
Travelling expenses of the gardener to Darjeeling - - -	200	-	-
Transport to Darjeeling from Calcutta 14 Wardian cases containing cinchona plants - - - - -	300	-	-
Travelling expenses of two native gardeners from Calcutta to Darjeeling - - - - -	50	-	-
Building a propagating house, with apparatus for heating the house, as per detailed estimate and plan - - - -	2,500	-	-
Total - - - Rs.	6,562	-	-
10 per cent. on the total amount to allow for contingencies -	656	4	-
GRAND TOTAL - - - Rs.	7,218	4	-

(signed) Thomas Anderson.

— No. 95. —

From *W. G. McIvor*, Esq., Superintendent Government Chinchona Plantations, Neilgherries, to *J. D. Sim*, Esq., Secretary to Government, Revenue Department, Fort St. George, Ootacamund, 9 May 1862.

Sir,

I HAVE the honour to acknowledge the receipt of the Order of Government of the 30th April 1862, No. 931, directing me to submit any observation I may wish to offer on Dr. Anderson's report to the Supreme Government, dated the 11th February 1862.

2. The successful cultivations of chinchona in India is a subject of such vast importance, that the Government will, I trust, excuse the candour and detail with which I proceed to discuss the merits of the report, as it is most important that all facts connected with this experiment be fairly and plainly represented, so that they may be understood, and duly appreciated by Government.

3. From a careful perusal of the report, the unfair manner in which the condition and prospects of our experiment is depreciated, combined with the disparagement of the great success and exertions of Mr. Markham, and the various discrepancies which the evasion of these facts necessitate, renders the object and meaning of the report difficult to be understood. Although the time which has elapsed since the report was written is comparatively short, nevertheless it has been sufficient to place Dr. Anderson in the position of offering arguments and opinions against developed facts, as our plants in the open air have now passed through the whole of this unusually dry and cold season, not only without injury, but they have, during the whole time, preserved the finest possible state of health, many hundreds of them having made shoots in this so-called fatal season of from 9 to 12 inches.

4. It is endeavoured to be shown, at page 4, paragraph 8, of the report under review, that our plants on the Neilgherries, from being artificially propagated, cannot bear the risks of a long journey; or, in other words, that they are more delicate than the Java seedlings, which Dr. Anderson had frequently seen "die after only touching the leaves on one occasion." Our young plants are subjected to as much handling as ordinary forest trees in an English nursery, and that they are better suited to bear a journey, is established by the results described by Dr. Anderson, who, in the first instance, states that "of those I brought the short journey from the Neilgherries to this, I lost nearly 10 per cent., while the plants from Java, which were seedlings, can hardly be said to have suffered at all." But this is an exaggeration of the losses with our plants, as at paragraph 4, Dr. Anderson informs us that "about 13 plants, out of 204, the entire number received, have been seriously damaged; the remainder, in the present genial climate of Calcutta, have quite recovered, and are as healthy as they were at Ootacamund." And again, at page 25, paragraph 20, Dr. Anderson states that 193 of the plants from Ootacamund were "growing most vigorously" on the 11th February, 1862; it thus appears that the loss of the plants from Ootacamund was less than 5½ per cent. The number of plants which Dr. Anderson delivered at Ootacamund, compared with those which he retained in the Calcutta Botanical Garden, and the number he originally received from Java, shows that the loss in transit of the Java plants was fully three times as much as the loss sustained on the plants he took from Ootacamund.

5. Another instance of extraordinary disparagement occurs at page 14, paragraph 4, where Dr. Anderson states, "I maintain that the successful rearing of the cinchonas in the greenhouses at Ootacamund is no more a proof that the climate of the Neilgherries is adapted for their cultivation than the fact that many thousands of seedlings, as well as cuttings, are now existing in imperfect health in the chinchona nursery at Kew, would lead us to expect that the plants will grow in the open air in England." This sentence conveys, as Dr. Anderson must be well aware, the most erroneous impression that can possibly be conceived, because in England the difference between summer and winter precludes the possibility of chinchonas ever being grown there; but how different is this climate, our extreme variation between summer and winter, taken from the observation of T. G. Taylor, Esq., made at Dodabetta, for 10 years, shows the extreme variation of temperature

here to be 25·25 degrees; the variation in England in usual seasons is 43·7 degrees, and in severe winters frequently 80 degrees. Dr. Anderson was here in the depth of the most severe winter we have had for 25 years, and the greatest cold that has ever been registered on the Neilgherries occurred at that time; yet, notwithstanding, Dr. Anderson saw hundreds of plants turned out daily into the nurseries in the open air at Neddivattum, without sustaining the slightest damage. Moreover, Dr. Anderson also saw six plants of different species, which had been placed out in September last in a cleared spot in the highest and coldest part of the Neddivattum site, which, at the time he saw them (December), all the species were in the finest possible state of health, although they had then passed through the coldest part of the season.

6. Dr. Anderson, in page 13, paragraph 3, shows that he was quite conversant with the object of our plants being placed in the glass-houses,* and states this to be "the wisest plan that could have been adopted," and it is unaccountable why this advantageous system of cultivation should have been in the very next paragraph converted into the means to impress upon the Government the very erroneous idea that the climate of the Neilgherries is as unsuited to the cultivation of cinchonas as the climate of England. I cannot pass over without remarking the rather confusing discrepancies in the report with reference to the sites. At page 3, paragraph 5, Dr. Anderson states, that "all the sites that Mr. M'Ivor had selected were carefully visited; their geology, meteorology, and botany, examined, and their characteristics noted." And again, at page 14, paragraph 3, while speaking of our plants, Dr. Anderson states, "they have been placed under these circumstances for two reasons—in the first instance, from there being no one in the Neilgherries who could point out the sites on those mountains best adapted for receiving the plants, and thus they were considered to be safer under the protection of a glass-house." And again, at page 14, paragraph 4, "the great difference that exists between the climates of the South American chinchona forests and the Neilgherries ought to have received greater attention than it has, and in the selecting of sites convenience of access from Ootacamund should have been made subservient to the greater consideration of climate." Also in page 19, paragraph 10, "with the exception of one, the sites that have been chosen are certainly the most favourable localities that could be found in the Neilgherries." I submit that the information which Dr. Anderson possessed did not justify the remarks above quoted, as Dr. Anderson was aware that all the sites were either selected or approved by gentlemen who had visited the chinchona forest of South America, and made a careful comparison of our climate with that of the chinchona regions of the Andes. And on reflection Dr. Anderson must admit that this gave their opinions infinitely greater weight than his own, which was necessarily formed on descriptions he had read of the climate of the Andes, as Dr. Anderson never visited the chinchona regions; and he cannot hold that reading a description of a subject can convey a more correct conviction than personal observations and experience. We all know how liable we are to misconceive and misapply a fact we have read or heard described, and that Dr. Anderson is not beyond the liability of falling into this error is illustrated at page 22, paragraph 14, of his report, where he quotes what Mr. Spence describes as the seriously damaging effect of wet weather on the plants to be a condition highly favourable and necessary for their development. It is plain to the most ordinary reader that Mr. Spence, from page 2 to 4 of his report of the 12th October 1860, speaks of the unusually damp season on the Andes as being likely to frustrate his undertakings, which, in his own words, was only rendered successful when, "towards the end of July, the weather took up, and in a few sunny days the capsules made visible advances towards maturity." Any one reading the severe losses of 1860, owing

* Mr. McIvor to Secretary to Government, 9th May 1861, No. 59, paragraph 11 :—"The plants brought out by Mr. Cross have been transplanted in our glass-houses, and are now favourably progressing in the process technically termed 'hardening off.' By this process they will in a few weeks be able to bear exposure without injury, and although they could then be transplanted in the Neddivattum site without the loss of a single plant, I would consider it very inadvisable to put them there, because a few plants put out into an immense forest swarming with wild animals would be liable to be entirely destroyed in one night, however well they may be fenced. Moreover, it is of the utmost importance that all the original plants be retained here, as this would greatly facilitate their propagation, and give us a stock of plants in 14 or 15 months, which otherwise could not be had for many years."

owing to the wet harvest, would not have fallen into a more serious error had he conceived that a wet harvest was highly beneficial, by causing the crops of grain to grow and rot in the ear.

7. Dr. Anderson endeavours to depreciate Mr. Markham's success and exertions to an extent which the facts of the case do not justify; with reference to the charge set forth of this gentleman's "ignorance of botany and science generally," the result of Mr. Markham's expedition entirely rejects. The cinchona seeds which Dr. Anderson himself brought to India were the produce of Mr. Markham's expedition, many hundreds of plants in Ceylon and Jamaica are the produce of the same; and we now on the Neilgherries possess upwards of 30,000 plants of nine of the most valuable species of chinchona,* all the result of Mr. Markham's exertions. In short, the success has been such as never before to be equalled by any endeavour on record to import plants; and, are we to believe this success to be the result of chance, directed by ignorance? Dr. Anderson might have been consistent, and instead of taking all the credit of conveying the plants from Java, to himself, he should have conferred it on the native gardener who accompanied him. Not only was Mr. Markham qualified to carry the importation of the plants with which he was entrusted to its present successful issue, but that gentlemen gave much further proof of his ability by affording such information and observations as has secured the successful management of the plants after their introduction. The correctness of this is now well established, for those who have attended to Mr. Markham's observations on the management of the plants have met with great success: while those who have either neglected or despised his theory, have met with comparative failure; and this indeed is the case with Dr. Anderson, who raised from Mr. Markham's seeds in the early part of last year, "about 80 seedlings," and the table given at paragraph 20 of his report, shows that these had decreased on the 11th February last to 31.

8. At page 11, paragraph 12, Dr. Anderson observes that "in concluding this general account of what I observed in Java, I may state that I was greatly impressed with the advantage in every way of having so important an experiment directly under scientific superintendence." It is difficult to trace the facts which made this impression on Dr. Anderson's mind; none capable of doing so are described in his report, nor are they to be found in the results of the Java experiment; but the contrary, for we find that the scientific gentlemen in charge of the operations in Java (perhaps through ignorance, or perhaps because the plant was hardy and grew rapidly) cultivated to a large extent, and at great cost an entirely worthless species of chinchona, to which they had erroneously attached the name of a valuable sort; these gentlemen were unable to discover their error, and unwilling to admit it when first pointed out; but now the fact has been indisputably established by the examination and analysis of Mr. Howard, both of specimens and bark from the Java plant, and also of the same species from its natural locality on the Andes. Again referring to paragraph 2 of Dr. Anderson's report, it appears Dr. Junghuhn has, in another instance, erroneously attached the name of *C. succirubra* to another worthless sort. Even in India we have examples of folly of this sort, which exceeds that of Java. An eminent

* LIST of the Number and Species of Chinchona Plants in Cultivation on the Neilgherries, on the 30th April 1862.

Botanical Names.	Commercial Names.	Number of Plants.	Value in the London Market, per lb. of dry Bark.	REMARKS.
			<i>s. d. s. d.</i>	
1. <i>Chinchona succirubra</i> - -	Red bark - - -	14,450	2 6 to 8 9	All in fine health.
2. Ditto - <i>Caliseya</i> - -	Yellow bark - - -	237	2 10 to 7 -	Do. do.
3. <i>C. Condaminea</i> Var, <i>Uritusinga</i>	Original <i>loxa</i> bark - -	1	2 10 to 7 -	Unhealthy.
4. <i>C. Condaminea</i> Var, <i>Chahaurguera</i>	Rusty crown bark - -	8,000	2 10 to 7 -	All in fine health.
5. <i>C. Condaminea</i> Var, <i>Crespilla</i> -	Fine crown bark - -	105	2 10 to 6 -	Do. do.
6. <i>C. lancifolia</i> from Java - -	Crown bark - - -	1	1 8 to 2 10	Unhealthy, affected by fungi.
7. <i>C. nitida</i> - - -	Genuine grey bark - -	2,922	1 8 to 2 9	All in fine health.
8. <i>C. Species</i> without name - -	Fine grey bark - - -	1,211	1 8 to 2 10	Do. do.
9. <i>C. micrantha</i> - - -	Grey bark - - -	3,786	1 8 to 2 9	Do. do.
10. <i>C. Peruviana</i> - - -	Finest grey bark - -	357	1 8 to 2 10	Do. do.
11. <i>Pahudiana</i> from Java - -	Unknown - - -	425	Worthless.	—
TOTAL No. of Plants - - -		31,495		

eminent medical gentleman of the Bombay service attached the name of *C. succirubra* to the wild Brinjal or *Solanum giganteum*, and so successfully, that the Governor of that province was induced to visit, and to express himself highly gratified by the appearance of the young Brinjal plantation which the medical gentleman in charge had honoured by the designation of *C. succirubra*. But it cannot be facts of this nature in which the advantage of scientific superintendence was made plain to Dr. Anderson. It is true that at page 11, paragraph 11, an "important" discovery of Dr. De Vrij is detailed, namely, that "in the roots of a tree of *C. Pahudiana*, only two years old, there was no wood with bark formed, but the herbaceous stem yielded nine hundredths of a grain of quinine," or a quantity so infinitely small that it cannot be comprehended: 480 grains make one ounce, this gives 5,330 trees to produce an ounce of quinine; at 25 feet apart, the distance the plants are placed in Java, this number will cover upwards of 60 acres. Dr. Junghuhn estimates the cost of "labour alone," for transplanting each plant from the seed bed to the forest, at one florin; this makes the cost of the quinine 5,330 florins per ounce, or 533 £; and this does not include grubbing up the roots, tending the plants for two years, &c., which would increase the cost to at least double, or 1,000 £ per ounce, and "these important discoveries" Dr. Anderson proposes to "commence at once to prepare to test." Surely, to the mind of every man the value of this discovery is plain, except indeed it be not so to the scientific man, who views his subjects from a lofty eminence, and disdains to think for a moment of its practical value.

9. In operations of this sort a correct knowledge of the science of horticulture is very necessary, and when combined with the knowledge of the practice also, together with the powers of correct reasoning, its advantages are enormous. It enables us to receive all theories with doubt when opposed to the laws which govern vegetable life. It points out to us our own shortcomings, and suggests the means of improvement. When matters go wrong it enables us to trace the true cause and apply proper remedy. But we have no record of the success of science, combined with practical ignorance, in this form, alas! science has ruined hundreds of men possessed of great energy and talent.

10. It was to be expected that the chinchonas on their introduction to India would have to struggle against the wildest theories, in the most conflicting opinions, with reference to their cultivations; as in all ages newly imported plants of great value have suffered more or less from this cause, and from the beginning I have been anxious to mitigate this to such a degree as not seriously to retard our progress, notwithstanding we have suffered to some extent, and may still suffer. I would therefore most respectfully submit for the consideration of Government the desirableness of giving us time to develop our results prior to gentlemen being deputed to report on the position of our experiment. For unless the gentlemen so commissioned have themselves gained greater results in the cultivation of the plants than we have, together with long experience of our climate, their reports can only confuse and embarrass the Government; while they are discouraging to those intrusted with the responsible and arduous duty of bringing the experiment to a successful issue. I may mention that had a commission been deputed to visit and report on the prospects of the chinchona experiment in Java, so recently after their commencement, as Dr. Anderson was deputed to the Neilgherries after the beginning of our operations, only two sickly plants would have been found in that island. That the reports are perplexing to the Government has been well established by the matter laid before them by Dr. Macpherson, who persuaded Government that chinchona plants could not be grown, or seeds raised in our glass-houses at Ootacamund. It has long ago been admitted by all parties, that we have grown our cinchonas in the glass-houses with unequalled success; and in a few months I hesitate not to state that all parties will be compelled to admit that our cultivation in the open air is equally successful.

11. In experiments of this sort the preliminary operations are the most difficult to accomplish, because every day adds to our experience and knowledge of the nature of the plants. Our success in the preliminary operations is indisputable, and it is mere trifling to argue that we will fail in the future stages; for if we were successful when we possessed only a slight knowledge of the nature of the plants, it is only reasonable to expect that we will be more successful when our knowledge becomes perfected by long observation and practical experience.

12. The remarks on the climatological characters of the sites on the Neilgherries,

gherries, described from paragraphs 10 to 14 of Dr. Anderson's Report, are calculated to give a very erroneous impression of the climate. The only perfect meteorological table for a whole year in my possession is that recorded at the Government Observatory, Dodabetta (the highest point on the Neilgherries), and published in the report of T. G. Taylor, Esq., H. C. Astronomer, dated Madras Observatory, 15th February 1848. The extracts at foot* are taken from this record, and entirely contradict the impression conveyed by Dr. Anderson. The variation of our climate is, as it indeed must be from our position near the equator, very little, the lowest temperature registered during the year being 40 degrees, while the highest was 67 degrees. I may observe that the mean temperature of the Dodabetta site is about $2\frac{1}{2}$ degrees warmer than the summit of Dodabetta, and the Neddivattam plantation at its upper limits is about five degrees warmer, while its lower limits is about 15 degrees warmer. Dr. Anderson selected for his observations a land-locked hollow, or the coldest part that could have been found in Ootacamund, and this is evident from his own report, as we are told in paragraph 7, that "on the night of the 24th December, eencalypti, a few accacias from Australia, roses, geranium, fuchsias, and many other soft-wooded garden plants, were destroyed; besides several indigenous shrubs, such as berberies, nepalensis and aristata and lobelia, excelsa, were blackened by frost." The plants which Dr. Anderson states to have been killed formed the principal growth all over the Neilgherries; so it must have been in some peculiar locality where Dr. Anderson observed the facts he describes. Dr. Anderson has been very unhappy in the selection of the facts he uses to impress us with an idea of the aridity of this climate. Referring to the dry season, he states that "during this period irrigation is absolutely necessary in the coffee plantations, especially on the eastern aspect of the hills, and even in the Wainád on the moist side." There is not a coffee plantation either on the Neilgherries or in the Wainád irrigated. His description of the botany also conveys an erroneous impression, as we have no plants in these forests with perennial roots and rapidly growing succulent stems "springing up at the commencement of the rains," fruiting and dying before the dry weather. The dried-up stems to which Dr. Anderson alludes being the stems of endopogon, barberia, and strobilanthus; these are plants which grow from five to seven years before flowering, and immediately they have flower and produce seed they die away; and this happened to be the case with many of the species last year, their dead stems filling the jungles at the time of Dr. Anderson's visit. With this tribe of plants Dr. Anderson is well acquainted botanically, but he would seem not to have studied their habits of growth.

13. With reference to our proposed plan of cultivating the chinchonas in the open ground without the shade of living trees, is a plan not opposed to the opinions of the great authorities on chinchona cultivation; nor is it, as Dr. Anderson states, opposed to the opinion of Dr. Weddell.† But it is certainly
opposed

* MONTHS.						Fall of Rain.	Lowest Temperature Registered.	Highest Temperature Registered.
						Inches.	Min.	Max.
January	-	-	-	-	-	1·2	40·0	62·8
February	-	-	-	-	-	7·43	41·2	61·0
March	-	-	-	-	-	3·61	43·5	67·0
April	-	-	-	-	-	19·80	40·0	66·0
May	-	-	-	-	-	4·86	46·3	65·8
June	-	-	-	-	-	4·55	44·0	60·0
July	-	-	-	-	-	7·41	44·3	59·0
August	-	-	-	-	-	9·32	44·5	59·1
September	-	-	-	-	-	7·52	41·8	59·0
October	-	-	-	-	-	12·49	42·8	58·8
November	-	-	-	-	-	11·85	42·9	58·8
December	-	-	-	-	-	12·28	41·0	60·4
TOTAL - - - Inches						102·14	42·47	61·35

† "I have no doubt that the Indian plantations will amply compensate the trouble and expense of maintaining them. With respect to conducting them we have as yet little or no experience. The only reason I can adduce for planting the young chinchona trees under the protection of a

opposed to the practice of the Dutch in Java; and I have explained in detail the reasons and necessity for this mode of cultivation in my letter to Government of the 20th January last. That the Dutch in Java have grown a worthless species under dense shade is no argument why we should cultivate the valuable species under similar conditions; but the contrary, as they have failed in the cultivation of the only valuable species they possess, namely, *C. Calisaya*. It is proverbial "that ill weeds grow apace," under the most adverse circumstances they can be placed in; and so exists the *C. Pahudiana* in Java under its adverse conditions. My own experience in the cultivation of chinchonas has been short, still it is sufficient to enable me to state that we will meet with great success in open cultivation. The observations and facts on which this opinion is formed will be detailed at length in my annual report, which I trust shortly to forward to Government.

— No. 96. —

MINUTE by Sir *William Denison*.

1. It appears to me that Dr. Anderson has mistaken the conditions of the experiment now making upon the Neilgherries as to the cultivation of the different species of chinchona. The object has been to ascertain whether, in a climate differing in many respects from that in which the chinchona is found, it may not be possible, by care and attention, to acclimatize the plant so as to perpetuate and cheapen the supply of a medicine, the importance of which in a country like India it is impossible to over estimate.

2. The Government and its agents are perfectly cognizant of the difference between the climate of the Neilgherries and that of the slopes of the Himalayas; they did not depend upon the brief experience of Dr. Anderson, who in a residence of about a week on the Hills in the depth of winter, could hardly be supposed to have acquired sufficient knowledge of the plan to have been able to lay down dogmatically either the laws which regulate the weather, or the action of this upon plants raised from seeds or cuttings in the locality itself, but they feel that there are quite sufficient grounds both in the statement of Mr. Markham who selected the site, and in those of others who have visited the experimental plantations in Java, to justify a belief that the chinchona in some of its most valuable species may be profitably cultivated on the Neilgherries, and they see nothing in the present paper of Dr. Anderson which would induce them to stop
the

slight shade afforded by other trees is that these plants, in their native country, have appeared to me never to grow beyond the state of shrubs when under other conditions; it may thence be inferred that the safest way of proceeding would be to plant the cinchonas at convenient distances in a quincunx alternately with some more fast growing trees, which may be cut away when no longer required. It is evident that the advantage to be reaped from this disposition must mainly depend upon the proper choice of these intervening strangers, it being kept in mind that they are placed there to protect and not to choke.

"Perhaps an equally good result might be obtained by planting the chinchonas without any intermixture, but very close together, so as to make them run up, and then thinning them out as might be required. At all events, it seems to be an essential point that, for a certain period, the soil and trunks of the young trees should be protected from the direct influence of the scorching sun, as plants so exposed have generally appeared to me to have a stunted growth.

"My reason for recommending the young plants to be placed in the open field, jointly with young trees of some other order and rather more fast growing than them, originated from the fact of my having always seen the Calisaya tree dwarf and stunted when growing in exposed or entirely open situations; whether the same thing takes place with other species seems doubtful, as Mr. Spruce says that the red bark tree thrives in open ground.

"At all events, I should never recommend planting any of these trees in the dense shade of the forest; in such a situation the greater part of them would evidently soon be smothered.

"If I have said that shade appeared indispensable to the trees at an early age, I never meant that they should have too much of it. I think that the trees in India ought to be planted in open ground, and close enough (if unmingled with other trees) to oblige each other to run up, sufficient space and air being gradually provided by judicious pruning and thinning out. A most important condition of success may be found in the choice of the proper time for planting out, the best being probably the beginning of the rainy season."—9 March 1862.

the experiment which has been commenced in such a satisfactory manner by Mr. Melvor.

3. This report should be sent to Mr. Melvor with a request that he would examine and give an opinion upon the various statements made.

(signed) *W. T. Denison.*

Enclosure in No. 96.

REPORT on the Number and Condition of the Chinchona Plants in cultivation on the Neilgherries, on the 30th April 1862.

Botanical Names.	Commercial Names.	Number of Plants.	Value in the London Market per lb. of dry Bark.		REMARKS.
			s. d.	s. d.	
1. <i>Chinchona succirubra</i> - - -	Red Bark - - -	14,450	2 6	to 8 9	The whole of the plants are in the finest possible state of health, with the exception of <i>C. lancifolia</i> and <i>C. Chahuarguera</i> . Our plants in the open air within the last two months in rapidity of growth, general health, and luxuriance, having much exceeded those in our glass houses.
2. " <i>Calisaya</i> - - -	Yellow Bark - - -	237	2 10	to 7 -	
3. " <i>Condaminea</i> Var. <i>Uritusinga</i>	Original Loxa Bark -	1	2 10	to 7 -	
4. " <i>Condaminea</i> Var. <i>Chahuarguera</i> .	Rusty Crown Bark -	8,000	2 10	to 7 -	The <i>C. lancifolia</i> , lately imported from Java, being affected by fungi at the roots, it is doubtful if we will be able to save it. As several cuttings of this sort although successfully rooted, the fungi, which apparently spreads along the pith, has attacked these rooted cuttings and killed them.
5. " <i>Condaminea</i> Var. <i>Crespilla</i> -	Fine Crown Bark -	105	2 10	to 6 -	
6. " <i>lancifolia</i> from Java - - -	Crown Bark - - -	1	1 8	to 2 10	The <i>C. Chahuarguera</i> only lately imported, and has suffered much during the voyage, the whole of the leaves and part of the young shoots having been dried up; still as it seems not to have contracted any disease, I hope it will recover.
7. " <i>nitida</i> - - -	Genuine Grey Bark -	2,922	1 8	to 2 9	
8. " species without name -	Fine Grey Bark - -	1,211	1 8	to 2 10	In the portion of our nurseries under the protection of the shade of living trees layers made in this position on the 3d January were found not to have rooted on the 27th April, while layers made at the same time in the open sunshine were found rooted by the end of the same month or in 28 days. The growth under the shade has also been unsatisfactory, not having in any case exceeded four inches in the last two months, while in the same period many hundreds of the plants in the open ground have grown from 12 to 16 inches. Nothing can exceed the luxuriance and bright healthy look of the leaves in the open sunshine, while the leaves on the plants under the shade are pale, and covered with small hairs.
9. " <i>micrantha</i> - - -	Grey Bark - - -	3,786	1 8	to 2 9	
10. " <i>Peruviana</i> - - -	Finest Grey Bark -	357	1 8	to 2 10	
11. " <i>Pahudiana</i> from Java - -	Unknown - - -	425	Worthless.		
TOTAL Number of Plants - - -		31,495			

Government Gardens,
Ootacamund, 12 May 1862.

(signed) *W. G. Melvor*,
Superintendent Government Cinchona Plantations.

OPINIONS on the proposed method of cultivating Chinchona on the Neilgherries.

Mr. Howard's opinion.—"I have read and carefully considered the proposed plan of cultivation in India; and have no hesitation in saying, I think Mr. Melvor is right in his views as to the best mode of planting out the chinchona; always supposing sufficient care is used to protect them for a year or two. With reference to the yield of quinine and bark which may be obtained by lopping and pruning the branches, I will let you have a specimen of *C. Calisaya*, which must have been grown as a shrub, and contains 4 per cent. of quinine, so that a large produce may be realized in this way."

Dr. Weddell's opinion.—"I have no doubt that the Indian plantations will amply compensate the trouble and expense of maintaining them. With respect to conducting them we have as yet little or no experience. The only reason I can adduce for planting the young Chinchona trees under the protection of a slight shade afforded by other trees, is that these plants, in their native country, have appeared to me never to grow beyond the state of shrubs when under other conditions. It may thence be inferred that the safest way of proceeding would be to plant the Chinchona at convenient distances in a quincunx alter-

nately with some more fast growing trees, which may be cut away when no longer required. It is evident that the advantage to be reaped from this disposition must mainly depend upon the proper choice of these intervening strangers, it being kept in mind that they are placed there to protect and not to choke.

"Perhaps an equally good result might be obtained by planting the chinchonas without any intermixture, but very close together, so as to make them run up, and then thinning them out as might be required. At all events it seems to be an essential point that, for a certain period, the soil and trunks of the young trees should be protected from the direct influence of the scorching sun, as plants so exposed have generally appeared to me to have a stunted growth.

"My reason for recommending the young plants to be placed in the open field, jointly with young trees of some other order, and rather more fast-growing than them, originated from the fact of my having always seen the *Calisaya* tree dwarfed and stunted when growing in exposed or entirely open situations, whether the same thing takes place with other species seems doubtful, as Mr. Spruce says that the Red Bark tree thrives in open ground.

"At all events I should never recommend planting any of these trees in the dense shade of the forest. In such a situation the greater part of them would evidently soon be smothered.

"If I have said that shade appeared indispensable to the trees at an early age, I never meant that they should have too much of it. I think that the trees in India ought to be planted in open ground, and close enough (if unmingled with other trees) to oblige each other to run up, sufficient space and air being gradually provided by judicious pruning and thinning out. A most important condition of success may be found in the choice of the proper time for planting out; the best being probably the beginning of the rainy season.—9 March 1862."

Mr. Markham's opinion.—"There can be no doubt that the correct method of cultivating the chinchonas is planting them out in the open, with plenty of light and air, they may require slight shade from the direct rays of the sun at first. The only really fine, well grown plant of *C. Calisaya* that I saw in Carabaya was one that had been planted in the middle of a clearing, entirely exposed; those in the forest were poor struggling things in comparison."

Mr. Spruce's opinion.—"The ridges on which the Red Bark grows all deviate a little from an easterly and westerly direction. It is far more abundant on their northern than on their southern slope, nor did I see a single tree with flowers or fruit in a southern aspect. The northern and eastern sides of the trees themselves had borne most flowers, and except on one tree of more open growth than the rest, scarcely a capsule ripened on their southern or western sides. These phenomena are explained by the facts that, in the summer season the trees receive most sun from the east and north, for the mornings are generally clear and sunny, whilst the afternoons are almost invariably foggy, and the sun's declination is northerly. Another notable circumstance is that the trees standing in open ground, pasture, cane-field, &c., are far healthier and more luxuriant than those growing in the forest, where they are hemmed in and partially shaded by other trees, and that while many of the former had flowered freely, the latter were without exception sterile. This plainly shows that, although the Red Bark may need shade whilst young and tender, it really requires (like most trees) plenty of air, light and room, wherein to develope its proportions."

Mr. Cross' opinion.—"In forming plantations of the Red Bark, I would cut down wholesale the entire forest, and allow it to deaden and dry, and then set it on fire. This should be done immediately before the rainy season, the plants should then be planted about 2½ or 3 yards distant. By the time that the rains are over, the plants will be large enough to shade each other's roots, it is the roots that require shading (not the tops) to prevent the too rapid evaporation of moisture from the ground during the sunshine. If done in this way, the Red Bark plants would soon grow up into a magnificent evergreen forest. Only that portion of the forest required for planting should be cut down and burned. By burning, the land is cleared of all noxious insects and will be in a fine healthy state for receiving the plants: and by the time that insects begin to accumulate again, the plants will be established and fully developed; and so will be beyond the attack of insects."

(True Extracts.)

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

— No. 97. —

ORDER of the Madras Government, 22 October 1862.

1. THE foregoing papers have reference to the experiments now being made upon the Neilgherries in the cultivation of the different species of chinchona. The Government resolve to bring them to the notice of the Secretary of State.

2. The following table shows the number of plants of each kind on the 31st August 1862:—

Botanical Names.	Commercial Names.	Number of original Plants and Date of Receipt.	Number of Plants on the 30 April 1862.	Number of Plants on the 31 August 1862.	Value per lb. of Dry Bark in the London Market.
					s. d. s. d.
1. <i>C. succirubra</i> - -	Red Bark - - -	457, April 1861	14,450	30,150	2 6 to 8 9
2. <i>C. Calisaya</i> - -	Yellow Bark - - {	6, April " - }	237	1,050	2 10 to 7 0
		48, Dec. " - }			
3. <i>C. Condaminea</i> , var. <i>Uritusinga</i> - -	Original Loxa Bark -	1, April 1862 -	1	41	2 10 to 7 0
4. <i>C. Condaminea</i> , var. <i>Chaharguera</i> -	Rusty Crown Bark -	Seeds, Feb. "	8,000	20,030	2 10 to 7 0
5. <i>C. Condaminea</i> , var. <i>Crespilla</i> - -	Fine Crown Bark -	" Feb. "	185	236	2 10 to 6 0
6. <i>C. lancifolia</i> - -	Pitayo Bark - -	4, Dec. 1861 -	1	1	1 8 to 2 10
7. <i>C. nitida</i> - - -	Genuine Grey Bark -	Seeds, Feb. "	2,922	8,500	1 8 to 2 9
8. <i>C. species</i> without name - - -	Fine Grey Bark - -	" Feb. "	1,211	2,440	1 8 to 2 10
9. <i>C. micrantha</i> - -	Grey Bark - - -	" Feb. "	3,786	7,400	1 8 to 2 9
10. <i>C. Peruviana</i> - -	Finest Grey Bark -	" Feb. "	357	2,295	1 8 to 2 10
11. <i>C. Pahudiana</i> - -	Unknown - - -	250, Dec. "	425	425	Worthless.
Total number of Plants -		766	31,495	72,568	

[Note.—Average present propagation about 10,000 per mensem.]

3. The Dodabetta plantation extends at present over 60 acres, of which 15 have been already occupied, while the remaining 45 are in various stages of preparation, and will be planted before the end of the current year.

4. The Neddivattum site comprises 150 acres, of which 21 have been planted, and the remainder more or less prepared. The actual plantation will be extended from 21 to 100 acres in the course of the present calendar year.

5. The Government are much gratified at the decided success attained in the propagation of the plant. Mr. McIvor's mode of culture, from the outset, is explained in full detail in the fifth of the papers recorded above (paragraphs 22 to 40), and nothing can be more satisfactory or promising than its results.

6. In the early part of last season, the experiment of planting out was first tried, and has been attended so far with marked success. Six plants were placed out in a cleared spot on the highest part of the Neddiwuttum site, about 6,200 feet above the level of the sea. These plants, including the most delicate variety (*C. succirubra*), have stood the cold of the winter, the drought of the spring, and the rain of the monsoon, and are now in the most vigorous and healthy condition, ranging in height from 36 to 42 inches, although only 15 months old. In fact, there seems little reason to doubt, that by proper care and attention, the plant may be cultivated in the open air on the Neilgherries with success.

7. The Government will not enter upon any lengthened discussion of the different views entertained by Dr. Anderson and Mr. McIvor as to the culture of the plant. The system adopted by Mr. McIvor has the support of Messrs. Markham, Cross, and Spruce, who alone have seen the plant growing in its natural habitation. It is consistent with the recognised principles of horticulture and, above all, has proved eminently successful in practice. The cultivation of the chinchona is still an experiment; but so far as present experience extends, the plan of open

planting has been most successful, and the Government will not abandon a system which has in every respect been attended with such satisfactory results. At the same time, the experiments under shade will not be discontinued, 55 acres on the Dodabetta site, and 15 at Neddivattam, having been reserved for that purpose.

— No. 98. —

EXTRACT from Sir *C. Wood* to Lord *Canning*.

My Lord,

India Office, London, 8 February 1862.

I HAVE considered in Council your letter dated 21st December (No. 97) 1861, forwarding correspondence relating to Dr. Anderson's recent deputation to Java; and I approve the acknowledgments made under your orders to the Governor-General of Netherlands India, for the courteous treatment accorded to Dr. Anderson, and for the collection of Chinchona plants and seeds placed at the disposal of that gentlemen.

2. With reference to the communication addressed by you to the Madras Government on the 9th of December 1861, that Government will no doubt be glad to receive any information which Dr. Anderson may be able to afford as to the cultivation of the Chinchona in Java; but I am of opinion that, in the conduct of the important experiment which is now proceeding in so highly satisfactory a manner, Mr. Melvor should be left to carry out his plans without interference on the part of other officers, and the Madras Government will therefore continue to be guided by the instructions on this point communicated to them in my Despatch of the 2d July (No. 27) 1861. It is, however, by no means my wish to limit the experimental cultivation of the Chinchona to those localities which have been already decided on, and I entirely approve your intention to send some of the plants obtained from Java to a site on the Khassia hills.

His Excellency the Right Honourable
The Governor General of India in Council.

— No. 99. —

From the Secretary of State for India, to His Excellency the Right Honourable the Governor General of India in Council.

My Lord,

India Office, London, 31 May 1862.

Para. 1. I HAVE considered in Council your Despatch of 28th February last, forwarding a copy of a further report by Dr. Anderson on the results of his recent deputation to Java; and containing his views as to the cultivation of the Chinchona plant in India.

2. I am fully aware of Dr. Anderson's ability, and this report contains evidence of the zealous interest with which he has studied the question. But I must, nevertheless, disapprove of the terms in which he has thought proper to express himself regarding Mr. Markham and his labours.

3. It is to him that India is primarily indebted for the acquisition of the Chinchona. He has studied the plant attentively in its native country, and I believe that many of his conclusions, derived from observation there, have been corroborated by science at home. But the transplantation is as yet an experiment only: there is much to be learnt which practice only can teach. And it is surely better for scientific men to recognise this fact, and not to allow such difference of opinion as they may feel respecting a project as yet uncertain to interfere with courteous communication of sentiments, or with co-operation as far as possible.

4. I have, therefore, only to repeat the expression of my desire, that no interference should take place, on the part of Dr. Anderson or anyone else, with the prosecution

prosecution of the experiments now proceeding in the Madras Presidency under the charge of Mr. McIvor.

5. But I have also to repeat the approval, conveyed in my Despatch of the 8th February last, of the intention of your Government to take measures for the cultivation of the Chinchona at Darjeeling, or elsewhere in that region, if a suitable spot can be obtained, with the aid of the abundant supply of plants which can, apparently, be derived from Ootacamund. Dr. Anderson will, I presume, be charged with the conduct of these operations, and will have an opportunity of testing the success, in India, of that mode of cultivation of which he has been led to approve.

6. Such further investigation as I have been able to make, has rather tended to confirm the opinion, though opposite to that apparently entertained in Java, that the *C. Pahudiana* is one of the less valuable kinds of Chinchona. I should think it unwise to be at any great expense in propagating it; but I do not wish that Dr. Anderson should be prohibited from making the experiment regarding the whole subject, as one on which the amplest information is desirable, and can only be obtained by degrees.

I have, &c.
(signed) C. Wood.

— No. 100. —

NOTE on the Cultivation of Chinchonæ, by Mr. Spruce.

Chanduy, near Guayaquil, June 1862.

MR. MARKHAM's notions on the cultivation of *Chinchonæ* entirely coincide with my own. If some empiric, who has never seen the *Chinchonæ* in their native country, has sufficient influence to induce the Indian Government to attempt to cultivate Chinchona plants according to some method distinct from the one proposed by those who have had that advantage, by all means let him be made responsible for the result.

The plan pursued by the Dutch, of growing the Chinchonas in the shade of dense forests, has always seemed to me most erroneous, and the person who devised it has read the lesson afforded by a study of the conditions of their existence on their native soil quite differently from what I have done. One of the first things that struck me in the great Amazonian forest was, the struggle for existence maintained among the individual plants which compose it. Not only (as among animals) are the more robust species and individuals continually harassing and displacing the weaker ones, but a parent tree (so far from cherishing) actually smothers thousands of its offspring beneath its own shade. Every place seems occupied, and of the seedlings which spring up under the large trees, not one in 10,000 can be expected to arrive at maturity, or to lift its head beyond the gloom, except an outlet be made for it by the decay and fall of its parent, or of some neighbouring giants of the forest. But let the same seedlings be planted in recently cleared ground, and nearly every one will prosper. I have seen the experiment tried, and the only indispensable precaution is, that it be done in the rainy season, when neither natural nor artificial shade is needed, but would, on the contrary, be positively prejudicial.

There are tribes of plants, always of humble growth and usually of obscure appearance, which naturally seek the shade. The sub-order *Coffeaceæ* (of the great order *Rubiaceæ*) has many examples of this propensity, and the coffee-tree itself is one of the most notable. In South American forests, the numerous species of *Psychotria* and other genera allied to *Coffea*, are nearly all shade-loving plants; but even these, granted their normal conditions of temperature and humidity, grow perfectly well in the full glare of sunshine; and I suspect they seek the shade because they find there a sufficient and unvarying humidity, rather than to avoid the light. The sub-order *Chinchonææ*, and especially the species of *Chinchona* itself, mostly seek to rise into the full influence of the light before they display their gaily-coloured flowers, whose development is essential to the permanence of the species. The officinal *Chinchonææ* are nearly all forest

trees, and those which are not have for companions bushes as humble as themselves.

My opinion is that, if the same climate can be found in India as the red bark tree possesses in its native country, no shade at all will be required after the plants are once well rooted. The fogs which prevail in the woods of Chimborazo are an all-sufficient shade, and it is only during four months in the year (June, July, August, and September) that the trees are exposed to (I would rather say enjoy) about six hours' sun per day. I believe if you consult Mr. Cross, you will find his opinion coincide with mine as to the expediency of allowing to the Chinchona plants the full influence of the light and air, provided that the necessary misty atmosphere and the freedom from violent winds can be secured.

As Mr. Howard has found slender quill-bark of *C. succirubra* so productive in alkaloids, Mr. McIvor's plan of growing the *Chinchona* as bushes or low trees, and of reaping an annual crop of bark from their lopped branches (similarly to what is practised with the Cinnamon), is well worth trial. Chinchona trees are only sparsely branched, but they are very patient of mutilation, and speedily put forth pairs of branchlets for every branch that has been lopped, if only one or two leaf-nodes have been left on. So much pruning might, perhaps, cause the trees to flower and fruit more than is desirable, but that can only be determined by experiment. Even if the trees were cut down, once for all, when arrived at maturity, I cannot but think that their cultivation (on an extensive scale) would be eventually remunerative. The man who plants a wood of oaks or elms cannot hope to live to cut down the trees for timber, but every year his plantation increases in value, and is so much capital at accumulative interest; and the same would be the case with a plantation of Chinchonas. In whatever way the question of pecuniary profit or loss may be decided, it is clear that, if we will have quinine, we must plant Chinchonas. In the forests where, a few years ago, Mr. Karsten speculated that the Chinchona trees would never be exhausted, I am informed that, at this moment, people are digging up old roots, the scanty supply of bark thus obtained being all that is now to be had there.

— No. 101. —

From *W. G. McIvor*, Esq., Superintendent Government Chinchona Plantation, Ootacamund, to *J. D. Sim*, Esq., Secretary to Government, Revenue Department, Fort St. George.

Sir,

Ootacamund, 31 May 1862.

1. I HAVE the honour to forward herewith the report on the Government cinchona experiment on the Neilgherries, for the official year ending the 30th ultimo. The accounts, which form an appendix to this report, require further examination, and will be forwarded hereafter.

2. I trust the Government will not consider that I have strayed from the legitimate subject of this report, by entering into a minute detail of our system of cultivation, my object being to endeavour to place in the hands of our assistants such information as may prove useful to them in the management of the plants. Should the Government approve of this, and be pleased to sanction the report being printed in a convenient pocket form, I respectfully beg to solicit the favour of being supplied with 50 or 100 copies for the use of the establishment, and for distribution to those anxious to try cinchona cultivation in this country.

REPORT on the Government Chinchona Experiment on the Neilgherries, for 1861-62.

1. It is now little more than a year since we fairly began the cultivation of the quinine-yielding chinchonas on the Neilgherries; and although our operations are necessarily in the first stages, the information which has been obtained with reference to the nature and requirements of the plants, their propagation and cultivation,

cultivation, and the general success which has attended our efforts, will, I trust, render this report not uninteresting. With the view of rendering the various subjects treated more easily referred to, I have arranged them under the following heads:—

Introduction of plants; reasons for attempting to introduce and cultivate in India - - - - -	Paragraphs 2 to 4
Species and varieties introduced, their nature and value - do.	5 to 17
Selection of sites for cultivation - - - - -	do. 18 and 19
Cultivation :—Outline of system pursued - - - - -	do. 20 and 21
Do. Propagation by seeds - - - - -	do. 22 and 23
Do. do. by layers - - - - -	do. 24 and 25
Do. do. by cuttings - - - - -	do. 26 and 27
Do. do. by leaves and buds - - - - -	do. 28 and 29
Do. under the shade of living trees - - - - -	do. 30 to 32
Do. in the open ground - - - - -	do. 33 to 35
Do. outline of proposed system - - - - -	do. 36 and 37
Do. proposed treatment for the yearly production of constant and uniform supplies of bark - - - - -	do. 38 to 40
Progress of operations - - - - -	do. 41 to 46
Establishments - - - - -	do. 47 and 48
Concluding remarks - - - - -	do. 49 to 52
Accounts.—Appendix A.	

2. The supply of Peruvian bark has for many years been inadequate to the demand—hence the steady and yearly increase in the price of this valuable medicine; and without any apparent hope of this state of the market giving way to a better, as the chinchona forests of South America are rapidly disappearing before the axe of the *cascarilleros*, it is evident that the produce of the Andes cannot long continue to meet the demands of European markets. In 1859, the Secretary of State resolved to attempt the introduction and cultivation of the various species of quinine-yielding chinchonas into India; and an expedition was organised in the early part of 1860, under the direction of Clements R. Markham, Esq., with a view to accomplishing this undertaking. Mr. Markham was assisted by Messrs. Spruce and Pritchett, as also by two practical gardeners, one of whom Mr. Cross, a very intelligent and enterprising young man, has aided much by his perseverance and judgment in bringing the introduction of the Peruvian bark to its present satisfactory issue; and it reflects much credit upon the Secretary of State, the judgment displayed in the selection of the agents employed to carry out this very hazardous and difficult part of the undertaking.

Introduction of plants; reasons for attempting to introduce and cultivate in India.

3. At the commencement of this expedition, Mr. Markham resolved not to cease in his exertions until all the various species and varieties of commercial value were successfully imported to India; and this, indeed, has been nearly accomplished, as we now possess nine of the most valuable species known in commerce. Three species or varieties in addition are known to produce rather inferior descriptions of bark, and these, although of less value than the species we possess, will, we trust, be introduced also, as their qualities may fairly be expected to improve under cultivation in this country, as indeed has been the case with most plants when imported and cultivated in other countries. For instance, we find that sugarcane, a native of this country, was exported to the West Indies in 1506; and although a few shoots only were successfully transplanted in their new abode, so well did they thrive, and so rapidly was the cultivation extended, that by the beginning of the 18th century, no less than 300 ships were employed in conveying this one product from the West Indies to different parts of the world. Rice also, a native of this country, was accidentally imported into America, where its cultivation extended with such surprising rapidity, and the quality of its produce so much exceeded that of India, as to be worth double the price in the market. Cotton, also a native of this country, was introduced into Egypt with equal results; so much indeed did it improve in quality, that even up to the present day, ordinary Egyptian cotton commands a price fully a half higher than the finest grown in India.

4. The present condition of our chinchona experiment holds out great promise, that its importation into India will be attended with results equal to those I have described as being effected by the introduction of sugarcane into the West Indies, rice to America, and cotton to Egypt.

Species and varieties introduced, their nature and value.

5. In dealing with this subject, I have considered it desirable not to encumber this report by botanical descriptions, and shall therefore proceed briefly to notice the species introduced, their commercial value, localities, and habits of growth.

Chinchonas yielding Quinine.

6. "*Cinchona succirubra*" the "*Cascarilla Colorada*" or "Genuine Red Bark" of commerce.—This species grows to a lofty tree, and is the most valuable known, being the richest in alkaloids, which generally amount to as much as 3 to 4 per cent., and thus "fair average samples are valued in the market at more than twice the price of calisaya bark." The present price of red bark varies from 2s. 6d. to 8s. 9d. per lb. of dry bark. This sort is also hardy, its range of growth extending from 3,000 to 8,000 feet; the plant, according to Mr. Spruce, prefers open ground, with "plenty of air, light, and room wherein to develop its proportions;" "the bark is thin in proportion to the diameter of the trees when growing at low elevations, and thick in proportion when growing at high elevations." The amount of alkaloids are also much affected by elevation. Mr. Spruce informs us that "Senor Cordovez (who has analysed the red bark collected at various altitudes) found that the greater the height at which the trees grow, the larger is the proportion of alkaloids contained in the bark." Of this species we now possess upwards of 14,000 plants, all in very fine health.

7. "*Chinchona Calisaya*" or "Yellow Bark of Bolivia."—This species grows to the height of a large forest tree, and was long considered the most valuable of all the medicinal barks; and certainly it was so, until the discovery of the red bark. The present price of calisaya or yellow bark varies from 2s. 10d. to 7s. per lb. Of this species we have evidently two varieties, very distinctly marked even when growing under the same conditions. According to Mr. Markham and Dr. Weddell, "the tree Calisaya grows on declivities and steep rugged places of the mountains 5,000 to 6,000 feet above the sea, in the hottest forests of Carabaya and Bolivia." Subsequently, Mr. Markham in writing of this species states, "There can be no doubt that the correct method of cultivating the cinchonas is planting them out in the open, with plenty of light and air; they may require shade from the direct rays of the sun at first. The only really fine well-grown plant of *Chinchona Calisaya* that I saw in Carabaya was one that had been planted in a small clearing entirely exposed; those in the forest were poor straggling things in comparison." Of this species we possess 237 plants in fine health; it is equally as hardy as the red bark, and as easily propagated.

8. "*Chinchona Condaminea*," var. *Uritusinga*; the "*Cascarilla fina*," or "Original Loxa Bark."—This species, which, in the days of La Condamine, was a noble and lofty forest tree, is now almost extinct, the trees of a large size having entirely disappeared from the Andes; it is rich in alkaloids, good specimens giving a total of 3·8 per cent., and in this respect it equals the Calisaya bark of Bolivia. It was common on the mountains of Uritusinga, and grows at elevations from 6,000 to 8,000 feet; a general opinion prevails among the cascarilleros that the bark of this species "differ in quality according as it is exposed to the morning or evening sun." Of this sort we possess only one plant, liberally presented to the Indian Government by J. E. Howard, Esq.; it arrived here on the 18th April 1862, and although much damaged by the journey is now in very promising condition.

9. "*Chinchona Condaminea*," var. *Chahuarguera*; the "*Cascarilla Colorado del Rey*," or "*Cascarilla Amarilla*," or the "Rusty Crown Bark" of English commerce, and of equal value to the preceding. This is nearly allied to the Uritusinga, inhabiting the same localities, but perhaps growing at greater elevations. In the days of Pavon this was a slender tree of little more than 24 feet in height, and is considered to be the species that produced the bark which cured the Countess of Chinchon. At the present time, Mr. Cross informs us, "but few trees are to be seen of these dimensions. The plants from which the bark of commerce is now taken are, in general, not more than 8 to 10 feet in height. When the plants are cut down, three or four young shoots, or suckers, in general spring up; but this does not always happen, as some of the more industrious cascarilleros frequently pull up the roots, and bark them also. The bark is taken from the smallest twigs; thus the annual growths are sometimes taken, especially if they are strong." Mr. Cross also observes, that "the alluvial deposit in the

ravines

ravines where this species is found growing is shallow, and in many places not more than six inches in depth." Of this sort we now possess upwards of 8,000 seedlings, and more are daily coming up. This sort is very hardy, and promises to be one of easy cultivation, and well suited to the highest ranges of these hills, especially the Dodabetta site.

10. "*Chinchona Condaminea*," var. *Crespilla* (*C. Crispa Tafalla*) or "fine Crown Bark."—This species is a small shrub, and contains a smaller quantity of alkaloids than the preceding; still it brings a high price in the market, being a "very fragrant and pretty-looking bark." It grows at great elevations, from 7,000 to 10,000 feet, in a deposit of peat, and where the temperature sometimes falls to 27° Fahr." We possess 105 seedlings of this species, which will no doubt prove well suited to the highest part of the Dodabetta site.

11. "*Chinchona lancifolia*" from Java, or "Crown Bark."—This is a species of third value; it is also hardy and easily cultivated, inhabiting the high and cold regions of the Andes; when growing in exposed situations, it produces a good bark. I regret, however, to state that this species cannot be considered as successfully introduced. Four plants of this sort were imported by Dr. Anderson from Java in December 1861; at the time they arrived the plants appeared in good health, but on removing them from the Wardian cases they were found to be affected by rot and fungi at the roots. They made some progress after being transplanted, and two of their tops were layered and successfully rooted. In January one of the plants died, and towards the middle of March the others were evidently affected by fungi and becoming sickly; as soon as the decay was observed to be making progress, the rooted tops were removed and placed in fresh earth, and promised to do well. By the end of March, the three original plants had died, and by the 15th April one of the rooted tops began to show symptoms of decay, and speedily died away. On examination it was found that the fungi had extended along the pith. We still possess one rooted layer, but it is doubtful if it will survive, as I fear it is also tainted with disease, and may any day die off.

Chinchonas yielding Chinchonine.

12. "*Chinchona nitida*," "*Quinacana legitima*," or "Genuine Grey Bark."—This is a lofty tree, abounding in the higher regions of Huanuco; its predominant alkaloid is cinchonine, and is consequently of less value than the preceding species, which belong to the class yielding quinine; the analysis of the bark from which our seeds were gathered gave 2.22 per cent. of alkaloids, consisting chiefly of cinchonine: Mr. Howard has, however, found quinine in samples of the fine grey barks of commerce. This species grows in exposed places, at elevations from 6,000 to 8,000 feet, and is said to delight in "free air, cold, water, and sunshine." Of this sort we possess about 3,000 plants, all in very fine health.

13. *Chinchona* species without name. Allied to the above, and raised from seeds gathered by Mr. Pritchett, near Huanuco. Mr. Howard is of opinion that this species may prove to be identical with *Chinchona obovata* of Pavon. It is said to be a "good bark," and extensively imported with the grey bark of commerce. We now possess upwards of 1,000 plants of this species, and we considered it desirable to stop the extension of the propagation of this plant, until we receive more correct information of its identity and value.

14. "*Chinchona micrantha*," the "*Cascarilla Provinciana*," or Grey Bark.—This is a lofty tree, inhabiting warm and damp forests, where it attains a great circumference—one tree frequently yielding from 200 to 250 lbs. of dry bark. The bark is generally rich in alkaloids, yielding as much as 2.70 per cent., principally consisting of cinchonine. Of this species we possess upwards of 3,700 plants.

15. "*Chinchona Peruviana*," the "*Cascarilla Pata de Gallinazo*," or "finest Grey Bark."—This species attains the height of an ordinary-sized tree in the Forest of Cocheros, where it is still abundant, growing at a lower elevation than *Chinchona nitida*, and yields a bark of considerable value; the bark of the trees our seeds were collected from, when analysed by Mr. Howard, yielded three per cent. of alkaloids, "comprising chiefly chinchodine and cinchonine." It thus ranks among the most valuable of the grey barks. Of this species we possess 357 plants, all in good health.

16. "*Chinchona Pahudiana*," the "*Cascarilla Crespilla Chica*" from Java.—This species was met by Dr. Hasskarl in the neighbourhood of Uchubamba, on the eastern side of the second Cordillera, "at an elevation of 5,500 to 6,000 feet above the level of the sea, in a very sandy micaceous soil, on dry sunny hills, without much shelter from the sun." A large number of this species were imported from Java by Dr. Anderson, and a few also were raised here from seeds obtained from the same source. We possess 425 plants of this sort, and as it is of no commercial value, the number will not be further increased.

17. The Dutch in Java, having fallen into the very serious error of erroneously attaching the name of a well-known and valuable species to this worthless plant, had proceeded in its cultivation "to a much greater extent than its properties at all warrant." This discovery indicated the necessity of caution on our part with reference to the value of our plants, and the correctness of the names attached to them; and an investigation of this subject, also made under the direction of Mr. Markham, together with the valuable assistance of Mr. Howard, has led to the most satisfactory results; and I believe that a doubt cannot be entertained as to the correctness of the names attached to our species, as in many instances the bark of the trees from which the seeds were gathered, and the layers procured, was subjected to analysis, in order to prevent the possibility of mistake.

Selection of sites
for cultivation.

18. As early as June 1859, the Right Honourable the Secretary of State for India called for information on the subject of the best localities in this Presidency for the cultivation of chinchona; and the Right Honourable Sir C. Wood, in a Despatch, dated 17th August 1860, directed that sites might be selected and "prepared for the cultivation of the plants." At that time we felt our information inadequate to enable us to perform this very important task with that degree of certainty required; although the sites likely to prove suitable were named, it was suggested that, prior to their final adoption, they should be examined and approved by Mr. Markham. It will be observed from what has already been said, that the various species of cinchona require different elevation and exposure, and only by a person thoroughly conversant with the subject could so very important a task as the selection of sites be expected to be successfully accomplished. Mr. Markham visited India towards the end of 1860, and feeling a difficulty in forming a correct opinion, owing to his inexperience of this climate, requested my aid in this matter. While on the Andes, Mr. Markham noted with great minuteness the various influences affecting the growth of the chinchonas: these observations were placed in my hands, which, combined with a long personal intercourse, enabled us fairly and impartially to discuss the altered conditions of our climate, and the consequent modifications required to be possessed by the sites we selected, in order to ensure success. It was felt at the time that much would have to be developed by practical experience; and so far as our operations have progressed, the correctness of the opinions originally formed by Mr. Markham have been faithfully developed.

19. It was proposed to confine our operations in the first instance to two sites—namely, one suited for the experimental cultivation of the higher-growing species, while the other was selected for such species as require a warmer temperature. With this view, the site near Neddiwuttum was fixed upon for our first operations, possessing as it does several advantages with reference to exposure, and varying in elevation from 4,500 to 6,300 feet above the level of the sea. The species to be cultivated here at the lowest elevations is the red bark of Ecuador, and the yellow or Calisaya bark of Bolivia, and on the higher elevations the crown barks of Loxa and the grey barks of Huanuco. The site at Dodabetta is of limited extent, being originally but a little above 60 acres; however, since the receipt of the *Chinchona crespilla*, we have included in this site about 25 acres more, as being likely to suit the habits of this species; and I trust that this arrangement will meet with the approval of Government. This site possesses a great variety of exposure, and a great variety of soil also, and thus offers great advantages for an experimental plantation. The species intended to be cultivated here are the *Chinchona nitida*, or genuine grey bark, and varieties of *Chinchona Condaminea*, namely, the original Loxa bark, the rusty crown bark, and fine crown barks of commerce. Northern exposures have been selected for all the sites; this has been considered desirable, as the sun's declination is southerly during our dry
• and

and cloudless season; consequently, the northern slopes of the hills are much more moist during this season than the southern slopes, which receive the rays of the sun at nearly a right angle; consequently, they become parched and dried up; and this we considered would be injurious to the cinchonas, and consequently avoided selecting southern exposures for our plantations.

20. The great losses which have generally been sustained by placing newly imported plants at once out in the open air, suggested to us the desirableness of placing our plants in the first instance under the protection of glass. This gave us the power of rapidly increasing the plants, while it offered the great advantage of enabling us to note with much accuracy the various conditions affecting their health and growth; and this was rendered of more importance, as the information we originally possessed with reference to the cultivation of these plants was so vague and ambiguous, and in many cases indeed so conflicting, contradictory, and absurd, that it rendered the attainment of early practical knowledge of great value; while we based our theory of cultivation upon the observations of Mr. Markham and the other agents employed in introducing the plants to India. Our first care was to ascertain the conditions on the Andes most favourable to the perfect development of the plants; it was also necessary to ascertain and fairly understand such conditions as were unfavourable.

Cultivation; outline of system pursued.

21. In the system of cultivation pursued here, we have simply endeavoured to administer to the greatest extent possible those favourable conditions, and to mitigate or remove the adverse ones. Although this system has been met by great opposition by gentlemen in this country, it is nevertheless one which has secured to us the great success we have obtained in so short a period; because the true principles of cultivation clearly point out, that while we follow nature in all that is beneficial, we should assuredly reject all that is injurious. Under this impression, we have latterly followed the system of open cultivation in every respect; we rear our seeds, strike our cuttings, and place out our plants in the nurseries, using as little shade as possible, and our results have incontestably established its great advantages.

22. The first sowings of our imported seeds took place in February 1861, and no certain data being given, our first operations were necessarily experimental, and consequently a number of the seeds were lost by being sown in too retentive a soil, and supplied with what (to chinchona seeds) proved to be an excess of moisture. The greatest success obtained in our first attempts was by the use of a soil composed almost entirely of burned earth, on which nearly 60 per cent. of the seeds germinated, the temperature of the earth being kept above 70 degrees Fahrenheit. The period required before germination took place varied from 62 to 68 days.

Cultivation; propagation by seeds.

23. A supply of seeds recently received of the valuable varieties of *Chinchona Condaminea* have made more satisfactory progress; these were sown on the 11th February 1862, on a very light open soil, composed of a beautiful open felspathic sand, with a small admixture of leaf-mould. Our experience with the first seeds plainly indicating that the cinchonas are very impatient of an excess of moisture, great care was taken in the preparation of the soil used in this sowing. The leaf-mould was, in the first instance, exposed to the sun for two or three days and thoroughly dried; it was then heated to about 212 degrees Fahrenheit, in order to destroy all grubs or larvæ of insects; after being allowed to cool, it was brought into the potting-shed, and watered sufficiently to make it moist, but only to that degree of moisture that the particles of soil would not adhere together when pressed firmly with the hand—that is, the earth, on being laid down, was sufficiently dry to break and fall into its usual form. The leaf-mould and sand in this state of moisture were mixed together and the pots filled, the surface lightly pressed down, and the seeds sown thereon being lightly covered with a sprinkling of sand. The pots were then plunged into beds of moist sand, on a bottom heat of about 75 degrees Fahrenheit; these were never watered in the strict sense of the word; when the surface became dry they were merely sprinkled with a fine syringe, just sufficient water being given to damp the surface, but never to penetrate or consolidate the soil. Under this treatment the seeds began to germinate very strongly on the 16th day after sowing, and still continuing to germinate, the principal art appears to be to keep the soil in a uniform state of moisture, but never wet. The least excess of moisture causes the seeds to

mould and damp off in thousands, while, as a matter of course, if kept too dry, they become parched up. As soon as the seeds have germinated, they are carefully pricked out into fresh earth (prepared as above described). This operation is a very delicate one;—the radicle being carefully raised out of the original seed-pot is removed to the new pot, being carefully covered with soil, while the seed lobes are kept well above the surface; in this way from 25 to 50 seedlings are transplanted into a five-inch pot, and then treated in every respect the same as the seeds, that is, they are never watered, the surface being merely sprinkled and the pots plunged in beds of damp sand, as before stated, to keep the soil in that medium state of moisture in which it was when first placed in the pots. The necessity for this care is to prevent the seedlings from damping off, to which they are very liable when treated otherwise; it also greatly facilitates their growth and the formation of roots, the earth in which they are placed being so perfectly open that it is readily affected by the action of the atmosphere, and thus kept in the most favourable condition for promoting vegetation. When treated in this way, our seedlings have made an average growth in one year of over 30 inches, while many of our seedlings which were raised and grown on a retentive soil have not attained the height of three inches in the same period.

Cultivation; propagation by layers.

24. As soon as our imported plants and seedlings had attained sufficient size,

they were propagated by being layered, as illustrated in the margin; in this way, they were found to root readily in about six weeks or two months at the latest, and the plants being bent down, it caused them to break, or throw out shoots from every bud along the whole length of the stem, and not only this, but many latent buds were developed, and a fine growth of young wood produced for succeeding layers and cuttings. In this way, each plant was treated as it gained sufficient size, namely, from eight to ten inches in height, until we had procured about 3,000 layered plants. Beyond this, we have not extended our

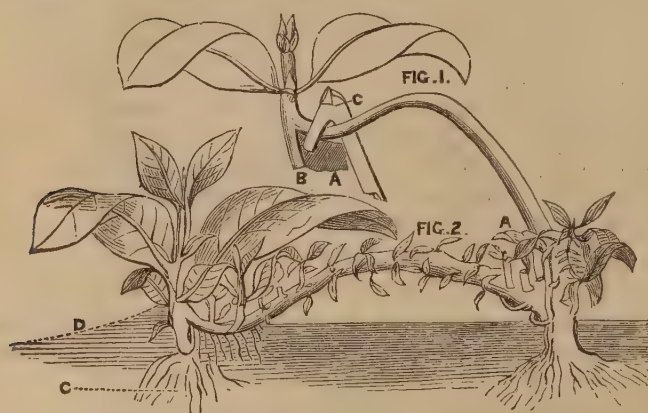


Fig. 1.—Layer as prepared for laying down. A, the piece of Brick; B, the tongue; C, the peg.

Fig. 2.—Represents the same plant, six weeks after being laid. C, the rootlets; D, the surface of the soil.

stock of plants for propagation, as we calculate that 3,000 plants will always yield us as many layers and cuttings as we can possibly require. The principle of layering we have adopted is somewhat different from that usually practised, as we found the juice of the chinchonas, when cut, flowed so freely from the wound, that if merely placed into the soil, it was apt to cause mildew and rot. To remedy this, a piece of perfectly dry brick is placed into the cut as soon as it is made; this absorbs the juice, and effectually prevents the ill effects it produced.

25. The layers, when well rooted, are removed from the parent plant, potted off, and kept in a close atmosphere for a few days, until they become established. In removing the layers, great care must be taken; for if they are cut off before the shoots shown in Figure 2, at A and B, have attained a good size, and fairly developed their leaves, the stock or parent plant is almost certain to die off. The reason of this is, the sap flows into the plant with equal vigour, but cannot be elaborated because of the removal of the leaves attached to the layer, and consequently it ferments and causes rot in the parent plant. So marked and undoubted is this fact, that if our trees are at any time cut down for their bark, not one in ten will survive; hence appears the necessity of the mode of cultivation detailed from paragraphs 38 to 40.

Cultivation; propagation by cuttings.

26. Our object being to produce the largest number of plants in the shortest possible space of time, our attention was early turned to growing the chinchonas by cuttings; and in this respect also, our first operations were not attended with the success desired. We soon discovered that cuttings from old wood, or rather from

from wood of three or four months' growth, was difficult to root, requiring from two to three months, and that it frequently damped off. It soon became plain, that the youngest wood that could be procured was the best adapted for making cuttings, as young tender shoots, a fortnight or three weeks old, formed roots in a very short space of time, the majority of these cuttings being invariably rooted within a month; it is, however, difficult to deal with this description of wood, and to secure success requires a great amount of care. The earth in which these cuttings are placed, is prepared as before described for the seeds; it is, however, kept a little drier. The cuttings, on being made, are placed around the sides of the pots, the cut end of each being pressed firmly on a piece of dry brick, as shown in the illustration in the margin. Each pot contains from 20 to 25 cuttings, and as they are filled, they are immediately removed to the propagation frames, and plunged into beds of damp sand on a bottom of about 80 degrees Fahrenheit.

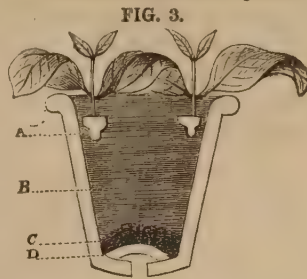


Fig 3.—Showing cuttings as placed in the pot, with the ends on a piece of dry brick. A, the brick; B, the soil; C, moss; D, potsherds.

27. The cuttings are now carefully watched, and their leaves moistened by a fine syringe when the atmosphere in the cases appears dry; they are, however, never watered, it being very necessary to ensure success to avoid this, as we have invariably found, that when the earth is once watered, it causes the cuttings to damp off, and seriously retards their rooting. The cause of this appears to be, that the cuttings not only suffer from excess of damp; but the soil when watered in the usual way, after the cuttings are placed in the pots, by its expansion and adhesion from the action of the water, the particles of soil are forced far too close together to be beneficial for the development of roots. With young wood, our losses with cuttings has recently not averaged 3 per cent. In removing the cuttings from the stock plants, one or two pairs of leaves and buds should, if possible, be left between the plant and the part cut; this is done in order not to decrease the succeeding supplies of young wood, which would be the case if the cut was made close to the parent stem. Another circumstance very necessary to be attended to in order to ensure success, is to be careful to place each cutting as it is made into the pot, with the cut end on a piece of dry brick; this must be attended to, because where the cut is made, the juice begins to flow, and this juice, if not immediately absorbed by the dry brick, causes mildew and rot. When the cuttings are placed in the cases, they are exposed to as much light as they can bear without flagging.

28. In December last, it occurred to me, that the plants could be successfully propagated by leaves with the bud attached; and as this method offered very considerable advantages in producing a large number of plants from a limited supply of wood, we resolved to attempt the experiment, which has been carried out most satisfactorily. The figure in the margin illustrates the method by which this is accomplished; the whole secret of success depends entirely on the amount of moisture given; if this is supplied in excess, they rot immediately, even in a day; but if sufficient care is exercised, the losses will not exceed 3 or 4 per cent., and this percentage has not been exceeded by many thousands we have propagated in this way: by this method, fine plants are obtained in every respect resembling strong, healthy seedlings. The period required to form roots is nearly the same in all the species, varying from three

FIG. 4.



Fig. 4.—1. Represents the bud A, prepared for placing in the pot, showing the cut part B, upon the brick C.
2. A pot of buds of *Chinchona Calisaya* 41 days after planting.
3. A bud of *Chinchona succirubra*: also 41 days after planting.

to form roots is nearly the same in all the species, varying from three

to six weeks. In the figure above given, the pot on the left represents six *Chinchona Calisaya* buds put in on the 30th January last, which were all rooted in 41 days after, being the date on which the drawing was made by Mr. Batcock. This drawing on the right, represents a rooted bud of the Red Bark put in at the same time. It may be observed, that it is not indispensable that a leaf be attached to the bud; this is no doubt a great advantage, although we have struck many buds without any leaf attached.

29. The usual way in which we prepare the buds is to remove the point of the shoots for a cutting; the stem is then divided near the middle of each internode, split down the centre, and immediately placed upon the brick in the pot, the bud itself being covered with about a quarter of an inch of soil, while the leaf, of course, projects above the surface; the pots are then plunged in damp sand, and treated in every respect the same as the cuttings.

Cultivation under
the shade of living
trees.

30. The entire adoption of this system has been endeavoured to be forced upon Government by the scientific gentlemen who have visited and who conduct the Java plantations. It is, however, a system of very questionable utility, as it has been in operation in Java for many years without producing the desired results; it moreover seems to have been adopted from a want of confidence in discriminating between the conditions which are beneficial, and those which are injurious in a state of nature, hence a slavish imitation of what has been described as the natural conditions under which the plants grow in their indigenous localities on the Andes. In cultivation, this implicit imitation of all the natural conditions under which plants must of necessity grow in a wild state, has invariably led to bad results; as indeed it must of necessity do, because the whole art of culture is vested in the very simple art of administering to the plants such conditions only as are conducive to their perfect development, and of removing or mitigating to the greatest extent possible such conditions as are injurious. To give a near example:—When coffee cultivation was attempted in Ceylon and in the Wainád, numerous intelligent and enterprising gentlemen imitated nature in this respect, and planted their coffee under shade; after eight or ten years, it was discovered that no return whatever could be obtained under such circumstances; and after this amount of time lost, money expended, and hopes disappointed, they had to begin and fell the whole of the shade, to the almost utter destruction of the plantations: and although we have been subjected to the criticisms of “obstinacy” and “stubbornness” in recommending a different course, I feel that it must be admitted that had we accepted arguments or opinions against facts daily developed before our eyes, together with the practical experience of generations, we would have given cause for much more serious strictures.

31. With the concurrence of Government, we have arranged to plant this season 75 acres of chinchona plants under various degrees of shade of forest trees; but only a few acres of this will be under dense shade, as our present experience has taught us that under such conditions cinchona plants cannot flourish. The main cause of this is that the roots of the forest trees immediately fill up the holes into which the chinchona plants are placed, thus depriving them of nourishment at the roots, while they are choked above for want of light and air. The production of alkaloids also cannot take place until the cinchona plants have overtopped the forest trees and expanded their heads in the open sunshine to enable them perfectly to elaborate their juices, and as this will require a period of 40 or 60 years, and the necessity for the destruction of the plantation to obtain the produce even after this lapse of time, this system, I fear, cannot be considered as one at all desirable to be followed.

32. The further suggestion, which has recently been recommended by Dr. Anderson to the Government of India, to grow *Chinchona Pahudiana*, because “nine-hundredth of a grain of quinine” had been found in the roots of one of these plants by Dr. De Vrij, seems insufficient to justify an expenditure of money in order to test the value of this discovery, as at this rate, to produce an ounce of quinine will require 5,330 trees. It is, however, added, that this had confirmed De Londre’s discovery, made about 20 years ago, “that the roots of cinchonas contained a larger proportion of alkaloids than the bark.” Unfortunately, De Londre himself gives an account directly the reverse of that above quoted as the results of his discovery, namely, that he obtained a much smaller proportion of quinine in

in the roots than in the bark, and that this small quantity was impure, in-crystallizable, and consequently of no value. In order that the Government may not be misled, I may mention that De Londre's discovery refers to the roots of chinchonas producing bark rich in alkaloids, hence so far from going to prove the correctness of the discovery of Dr. De Vrij, its tendency is to prove the reverse; for if the roots of cinchonas producing bark rich in alkaloids only yielded a very small quantity of impure quinine, the conclusion is plain that a species such as the *Chinchona Pahudiana* which contains little or no alkaloids in its bark, must have still less in its roots.

33. In the early part of last season, several plants of different species of chinchona were planted out under different conditions, in order to test experimentally which would be the safest system of cultivation to pursue. These plants have been carefully watched and treated in every respect alike, and the result has been that the plants placed without the protection of any living shade has made the most satisfactory progress, and borne the dry and cold weather without the least injury. The plants placed under living shade were found to be damaged in some degree during the rains by the incessant drip; however, on the weather clearing up, they threw out fresh leaves and quickly recovered, but towards the end of the dry season these plants were found to be suffering considerably from the drought; on taking a few of them up, it was found that the holes in which they were placed had become filled by the fibres of the roots of the forest trees in the neighbourhood, which had drawn up the whole of the moisture and nourishment from the soil in which they were planted. The average growth of the plants under shade from the end of September 1861 to the 14th May 1862, has been about three inches.

Cultivation in the open ground.

34. In putting out the plants which were placed in the open without any living shade whatever, we saw from the first that we had to combat with the young plants the bad effects of excessive evaporation, during our dry season, under a bright and scorching sun; we also saw the injury likely to be done to the plants by excessive radiation during bright and cloudless nights. To obviate these disadvantages, the plants were sheltered on the approach of the dry weather by a rough enclosure of bamboo branches with the leaves adhering to them, so as to give the plants sufficient shelter both from the effects of evaporation and radiation. The manner in which this is accomplished is illustrated in the margin. In addition to this shade of the branches of bamboos, the soil around the roots of the young chinchona plants was covered with one or two inches in thickness with half-decayed leaves, and the plants thus treated have a very great luxuriance which has not been exceeded by any of the plants in our propagating-houses. To ascertain the cause of this luxuriance, a few plants were examined at the end of the dry season, when the soil about the roots was found perfectly moist, and thousands of young roots of great strength had penetrated the covering of decayed leaves. The following table illustrates the growth of six plants placed out in a cleared spot on the highest and coldest part of the Neddivattum plantation :—

FIG. 5.

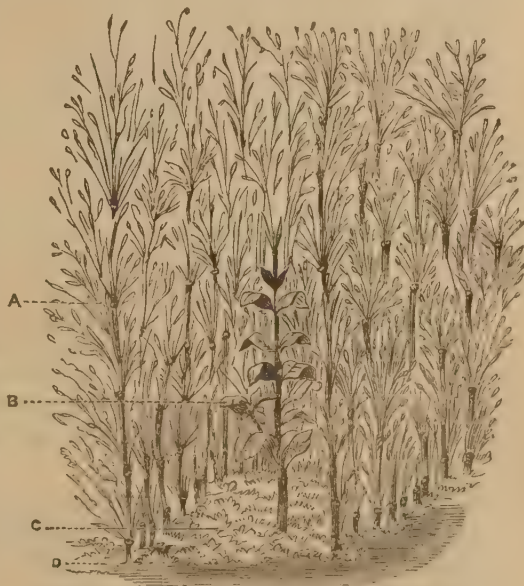


Fig 5.—Represents the manner in which the dead shade of Bamboos, &c. is applied, the open space being on the North side. A, the Bamboo; B, the plant; C, the dead leaves; D, the ground.

Height of Plants when planted on the 29th September 1861.			Height on the 14th May 1862.		
		<i>Inches.</i>		<i>Feet.</i>	<i>Inches.</i>
No. 1.	Chinchona succirubra	9	-	-	2 5
- 2.	Ditto - ditto	4	-	-	2 3
- 3.	Ditto micrantha	3½	-	-	1 4
- 4.	Ditto - ditto	3	-	-	1 4
- 5.	Ditto nitida	3½	-	-	1 7
- 6.	Ditto - ditto	3	-	-	1 6

35. This result cannot but be viewed as most satisfactory; it establishes beyond a doubt that our chinchona plants will grow well under open cultivation, and thus the experiment will no doubt secure to us all the advantages we can desire. It is not only upon these six plants that this opinion is founded, but also on observations made upon many hundreds of plants placed out in our nurseries in December last; a portion of our nurseries were left partially shaded by living trees, while other portions were entirely open; at the end of March the plants shaded by living trees had scarcely made any progress, while those in the open portion of the nursery had grown upwards of a foot; we therefore cut down the whole of the trees which shaded the nursery with the exception of one, which could not be felled without damage to the young plants.

Cultivation; outline of proposed system.

36. From the observations made under the preceding head, I would respectfully recommend to the Government that in our operations of next season, the principle of open cultivation alone be pursued. This system is not, in fact, so great an outrage "on the habits of the genus" or on the opinions of authorities on chinchona cultivation as recently represented by Dr. Anderson. The description already given of the plants abundantly proves this fact. And with reference to the opinions of authorities, with the exception of the gentlemen in Java, they are unanimous in pronouncing this open system of cultivation to be right; even Dr. Weddell,* who has been frequently quoted as entertaining a different view of the matter, distinctly approves of this system of culture.

37. The advantages of open cultivation are such as cannot fail to carry conviction to the mind of every man who will give the subject a moment's serious consideration, as it enables us at once to place our plants out under the most favourable conditions to promote their growth. The soil is not impoverished by the roots of neighbouring trees, the plants cannot suffer from drip, nor from the effects of evaporation or radiation, as the dead shade affords them, in this respect, a far more efficient and certain protection than could possibly be given by any living shade, while instead of impoverishing it enriches the ground; it also possesses the incomparable advantage of being entirely under our own control, it can

* "My reason for recommending the young plants to be placed in the open field, jointly with young trees of some other order, and rather more fast-growing than these, originated from the fact of my having always seen the calisaya tree dwarfed and stunted when growing in exposed or entirely open situations; whether the same thing takes place with other species seems doubtful, as Mr. Spruce says that the red bark tree thrives in open ground.

"At all events I should never recommend planting any of these trees in the dense shade of the forest. In such a situation the greater part of them would evidently soon be smothered.

"If I have said that shade appeared indispensable to the trees at an early age, I never meant that they should have too much of it. I think that the trees in India ought to be planted in open ground, and close enough (if unmingled with other trees) to oblige each other to run up, sufficient space and air being gradually provided by judicious pruning and thinning out. A most important condition of success may be found in the choice of the proper time for planting out, the best being probably the beginning of the rainy season."

(signed) H. A. Weddell.

(True Extract)

(signed) W. G. McIvor,

Superintendent Government Chinchona Plantations.

can thus be adjusted exactly to suit the seasons. In the wet weather, when shade would be decidedly injurious by promoting the growth of fungi and causing rot, it can be removed; while, in the dry season, it can be increased to any extent necessary. It also enables us at once to place the plants under the most favourable conditions for the development of the alkaloids, and under this system of cultivation I have no doubt that many of the species will give a supply of bark, in from six to seven years after planting, and that in eight to ten years they will give a large yearly supply. This artificial shading will of course be required until the plants attain sufficient size to cover the ground, which will probably be in two years or less.

38. In a state of nature all products are reaped in the most improvident and reckless manner possible; but the moment the plants are brought into cultivation this must cease, and the harvesting of the produce of the present year must be effected in such a manner as not to injure that of succeeding years. Although in the forests of the Andes the trees are cut down and stripped of their bark, such a system can never be profitably put into operation in cultivation, and another more suited must therefore be devised. I would suggest that our trees be planted in such a manner as to secure the constant and uniform yearly supply of bark by simply lopping and pruning the trees; if this operation is conducted with skill, the plants will be benefited rather than injured by the yearly removal, before the middle of the dry season, of a certain portion of their branches. This will not retard the growth of the plants, nor indeed can any damage arise from an attempt to carry out this system, which has been brought to the notice of Mr. Howard, and that great chemical authority considers "that a large produce may be realized in this way."

Proposed treatment for the yearly production of constant and uniform supplies of bark.

39. In the first years, probably from the sixth to the eighth after planting, the produce will be comparatively small, and be entirely of the description known in the market as quill bark, but after the 12th year of the growth of the plants a large proportion of the loppings and prunings will produce what is known in the market as flat or trunk bark. As an argument against this system, it has been advanced that chinchona plants do not throw out any branches, but this is a mistake, as we have some plants, although a little more than 15 months old, with 11 to 13 branches, and some of these branches themselves measure $3\frac{1}{2}$ feet in length, and the secondary branches one foot four inches. There is certainly nothing in the habits of all the species of this plant but what promises to be admirably suited to this method of cultivation; and from our own observations I feel convinced that much, if not the whole, success of the cultivation depends upon our results in this part of the operation. For if, as stated by the Dutch in Java, the plants will not attain sufficient size to produce bark under 40 or 50 years, then chinchona cultivation can never become of commercial importance, but this is not at all likely to be the case; for if our plants continue to attain the same rate of growth as they have done, we have every promise of a small supply of bark even before the lapse of the period mentioned above, and we can reasonably expect that our plants, when once well established, will attain greater luxuriance than they have hitherto done.

40. In order to obtain the greatest produce from our plantations at an early date, it appears to be desirable to place our plants rather close together, and with this object in view in our operations of this season we have prepared to place the shrubby varieties at a distance of from seven to eight feet apart, which will give about 889 and 680 plants respectively to the acre; the layer-grown species at nine and ten feet apart, which will give about 537 and 435 plants to the acre. This of course would be much too close to remain to attain their full size, but when they begin to crowd and impede the growth of each other they can be thinned out; and this operation will no doubt furnish a large supply of bark, as they will probably not require to be thinned out before the 12th year of their growth, as when they first begin to crowd sufficient light and air will be afforded by lopping and pruning a portion of the branches.

41. The propagating-house sanctioned by Government in July last was finished by the end of December, and has been found most complete and efficient in its working details; some delay was caused in the progress of this work owing to the heavy rains in October and November, as also by the inexperience of the workmen in erecting a building, it was found difficult to get the

Progress of operations.

furnaces and flues built in such a manner as to give a steady and efficient heat to the soil in the propagating frames. This, however, was successfully accomplished, and the house in full working order and filled with plants by the 1st of January. The house contains fifteen propagating frames, and each of these holds about 1,200 cuttings, or in all sufficient space for about 18,000 cuttings; the house also contains as much space as that occupied by the propagating frames for the growth and propagation of plants by layers and for hardening off such plants as are rooted. The cost of this building amounts to about 2,100 rupees.

42. *House for European Gardener.*—This building was completed by the latter end of January, at a cost of about 1,350 rupees; at the suggestion of His Excellency the Governor, who visited the work at the time the foundations were being laid, the rooms were enlarged, and the house now contains two main rooms 12×14, three verandah rooms, one being 7×14, the other two 6×14, with open verandah 7½×14, together with kitchen, store-rooms, and pantry.

Overseer's house, Dodabetta Plantation.—This building is not yet quite finished, but is in a very forward state. In estimating for this building it was proposed to be done temporarily, namely, with bamboo roof; but, as our operations progressed, I considered it desirable to construct this as also a house for the Head Propagator in a permanent and durable manner, and consequently the buildings have been substantially erected with burnt bricks, the corners, jams, and chimneys being laid in chunam, and the whole of the timber and roofs of teakwood. I hope to be able to finish these buildings in this substantial manner for only a trifle more than the estimates for the temporary buildings, and I trust the Government will approve of the alteration.

Propagator's house.—This has been erected close to the propagating-house, as it was found indispensable that the Propagator should be on the spot in order to give the plants and cuttings that amount of attention which is necessary to ensure success. This building will be completed in a few days.

Coolies' quarters.—These have been built with burned bricks, teak rafters, and bamboo reepers.

43. The difficulty experienced in getting artizans to proceed to Neddiwnttum, has rendered it now impossible to get the permanent building there completed before the setting in of the rains; therefore small but comfortable temporary buildings, with teakwood doors and windows, have been erected for the assistant superintendent in charge of the plantation, as also for the overseers, with store and tool houses, and accommodation for about 200 workmen. The permanent buildings will be proceeded with immediately the rains are over; all the materials, including doors, windows, &c., being finished there will then be no delay.

44. *Felling.*—On the Neddiwnttum plantation about 85 acres have been felled, cleared, and prepared for planting this season; and as our work was much delayed last season by the forest not being felled in time, I considered it desirable to fell about 50 acres for next year's planting, so that our work may not be delayed at the commencement of next season. On this plantation about 15 acres have been cleared for planting under the shade of living trees, and on the Dodabetta site about 55 acres have been prepared for placing out the plants under various degrees of living shade; in only a small portion has the underwood been cleared away, and here the chinchona plants will be placed out under dense shade; but the greatest portion of the land is almost entirely cleared, only sufficient living trees being left to give efficient shelter and slight shade. Here also five acres are entirely cleared of forest; consequently the results on this plantation will enable us to form a correct opinion of all the advantages and disadvantages likely to accrue from the two systems of cultivation, and all the intermediate stages between them.

Trenching and pitting.—After the roads being either formed or marked out, our trenching and pitting operations were begun; at Neddiwnttum ten acres of trenching have been completed, and on the Dodabetta site about 21 acres of land has been trenched, and 25 acres pitted. The whole of this site will be prepared by the end of May, when with the approval of Government we will proceed to pit and trench the 25 additional acres on this site intended for the cultivation of *Chinchona crespilla*.

45. *Enclosures*.—As above mentioned, the difficulty of getting artizans to proceed to Neddinuttum, the walls to enclose this plantation have not been begun, although many of the bricks have been made; it has therefore been found necessary to enclose this site with a strong temporary fence. The Dodabetta site is nearly enclosed by a turf wall and ditch on three sides, and on the fourth by a wooden fence; the brick wall around the nurseries is now in progress.

46. *Increase of Plants*.—Next in importance to that of introducing a valuable plant is its increase and multiplication, and with this object in view great attention has been given to this part of our operations, which has been much facilitated by the efficient working of the new propagating-house. The following table gives the number of plants on the 30th April, or at the end of the official year :—

Botanical Names.	Commercial Names.	No. of Plants.	Value in the London Market per lb. of Dry Bark.				Remarks.
			s.	d.	s.	d.	
1. <i>Chinchona succirubra</i> -	Red Bark - -	14,450	2	6	to 8	9	In fine health.
2. Do. <i>Calisaya</i> - -	Yellow Bark - -	237	2	10	to 7	-	Do. do.
3. Do. <i>Condaminea</i> , var. <i>Uritusinga</i> -	Original Loxa Bark	1	2	10	to 7	-	Promising.
4. Do. <i>Condaminea</i> , var. <i>Chahuarguera</i> -	Rusty Crown Bark	8,000	2	10	to 7	-	In good health.
5. Do. <i>Condaminea</i> , var. <i>Crespilla</i> - -	Fine Crown Bark	105	2	10	to 6	-	Do. do.
6. Do. <i>lancifolia</i> from Java - - -	Crown Bark- -	1	1	8	to 2	10	Unhealthy.
7. Do. <i>nitida</i> -	Genuine Grey Bark	2,922	1	8	to 2	9	In fine health.
8. Do. species without name - -	Fine Grey Bark -	1,211	1	8	to 2	10	Do. do.
9. Do. <i>micrantha</i> - -	Grey Bark - -	3,786	1	8	to 2	9	Do. do.
10. Do. <i>Peruviana</i> - -	Finest Grey Bark	357	1	8	to 2	10	Do. do.
11. Do. <i>Pahudiana</i> from Java - - -	Unknown - -	425	Worthless	-	-	-	Do. do.
Total number of Plants -		31,495					

Although this increase is highly satisfactory, we have been materially retarded in this respect by supplying, at the end of December last, to Dr. Anderson, for cultivation in Bengal, 204 well-established plants of different species of chinchonas, the greater portion of these being of the most valuable species we possess; these by this time would have produced many thousands. Still, the distribution of these plants will be more beneficial to Government than if they had been retained here; should the localities selected for their cultivation prove suitable, the plants will no doubt be increased with the same rapidity as has been attained here. With our red bark plants the increase of the year is upwards of 2,000 per cent., and equal results have been attained with all the species in proportion to their value:—that is, species of less value have not been propagated to such an extent.

47. General difficulty was experienced, especially in the first stages of our operations, in getting together a tolerably efficient establishment; and although this condition of affairs has lately considerably improved, still we are far from possessing an establishment with the general requirements necessary for conducting operations of this description. This, indeed, was to be expected, as the cultivation of the plants is new; and even in organizing an establishment for any undertaking, it requires time to bring it to an efficient state of working. In the propagating department, the effects of carelessness and ignorance in the management of the plants were productive of the most serious losses. I have been much assisted since the arrival of Mr. Batcock in October last; and I have every reason to be highly satisfied with the intelligence, ability, and zeal with which he has performed the duties entrusted to him. Mr. Patmore, the head overseer on the

Establishments.

Neddiwuttum plantation, has also taken a great interest in his work, exhibiting an unusual amount of skill in the management of the plants, and is in every respect well qualified for promotion. Mr. Lyall, the European gardener recently engaged by the Secretary of State, arrived here on the 18th ultimo, and has been placed in charge of this plantation. The other overseers, although willing and anxious to give satisfaction, have exhibited a want of knowledge in the management of the plants and the direction of labour, which I have found great difficulty in improving. Every endeavour, however, is being made to obtain men possessing the various qualifications required.

48. *Office.*—I have seriously felt the want of a good accountant and office manager, the salary (40 rupees) at present allowed being insufficient to secure the services of a man possessed of the abilities required. Mr. Hollis, recommended by the Forest Department, conducted the office duties until the end of October last, when, being offered a higher salary by the coffee planters, he left this employ without due notice, or delivering over the records and account of his office, which put me to much inconvenience.

Concluding
remarks.

49. So far as our operations have progressed, this experiment has been eminently successful, both as regards the number, genuineness, and value of the species introduced, their increase and cultivation. The very important fact has also been established, that the climate of the Neilgherries is suitable for the growth of all the most valuable species of chinchona, and that the plants possess as great power of withstanding extremes of wet and drought as is generally the case with evergreens. It has also been ascertained that the chinchonas, like nearly every other plant, has a distinct period of growth, which extends over about nine months of the year, the remaining three months being one of comparative rest. This has especially been clearly demonstrated by our seedlings in the glass-houses, for although the temperature and moisture was kept nearly uniform through the year, yet towards the season of rest the growth of the plants became less rapid, the upper leaves assuming a leathery texture, while the lower leaves became red and fell off, thus exhibiting the usual signs of a definite season of rest: this was the case with all the species, but not so marked in the *Chinchona nitida*, although this species also exhibited unmistakeable signs of a season of comparative rest, while immediately on the return of spring the whole of the species began to grow with renewed vigour. I record these observations, as it is generally believed that the conditions most favourable for the growth of these plants "are those of continuous vegetation;" and although this is literally correct, because vegetation never fairly ceases, yet it conveys somewhat an erroneous impression; for it is evident from the indications the plants themselves have given of their nature, that to urge them to an equal continuous growth would do serious damage, by preventing the perfect elaboration of the juices of the plants, a condition to which they are undoubtedly subjected in their natural localities on the Andes, and this condition is, no doubt, essential to their well-being.

50. Our plants have, in the most satisfactory manner possible, passed through all that we had to fear from the effects of this climate,—namely, the dry season, and hailstorms, to which we are liable in the spring of the year. Our dry weather certainly presents no insurmountable difficulty to the successful cultivation of the chinchonas, and it is likely to prove highly beneficial in promoting the production of alkaloids: the only difficulty our dry season presents is that it renders the operations with the young plants more difficult for a year or two, but when once the plants are fairly established, it cannot be productive of any inconvenience whatever. It is indeed very questionable if our dry season, especially on the western side of the Neilgherries, is so severe or of so long continuance as that of the cinchona region on the Andes, as we frequently read of the jungles there being periodically set on fire, while here the drought has seldom been experienced sufficiently severe to render this possible. The hailstorms, as they happen before the young leaves of spring are expanded, do comparatively little damage to the plants. From the effects of hail our chinchonas have not suffered more than any other introduced plants which luxuriate all over these hills.

51. Although the increase in the number of the plants of last season has been very satisfactory, still we may expect far greater results this year, as we now possess a more perfect knowledge of the system of propagation, and more efficient appliances,

appliances, so that during this year we may calculate on producing at least 150,000 plants. I would therefore respectfully suggest, that the plants be offered for sale to the public in January next, at the following rates,—namely, 500 rupees per 1,000; 300 rupees for 500; 200 rupees for 150; 100 rupees for 50, or 4 rupees per plant for any number under 50. We have now numerous applications for plants, both from planters in this Presidency and from Bombay; and as the number required is generally large, I thought it desirable to fix a low price upon the plants when a thousand or upwards are taken by one purchaser: and I think it is more desirable that our plants be sold to private individuals than gratuitously distributed, which is apt to lead to the loss of the plants, because persons do not generally value that which they receive for nothing, whereas those who purchase plants at a fair price establish by this act that they value and consequently will take care of them; moreover, it will induce purchasers to propagate and increase the plants themselves, and thus greatly facilitate the extension of their cultivation.

52. In concluding this report, I beg to tender my grateful acknowledgments to his Excellency Sir William Denison and the Government of Madras, for the confidence they have reposed in me while conducting the operations of this important experiment through its most critical stages, and at a time when the correctness of our own views had not been practically developed, and many conflicting theories pressed upon Government. My best acknowledgments are also due to Clements R. Markham, Esq., for much valuable assistance and information, which has greatly contributed to the successful development of this undertaking; also to J. E. Howard, Esq., for his contribution of the valuable species of *Chinchona Uritusinga*, and for much important scientific information.

(signed) W. G. McIvor,
Superintendent Government Cinchona
Plantations.

Government Gardens, Ootacamund,
31 May 1862.

— No. 102. —

From W. G. McIvor, Esq., Superintendent Government Cinchona Plantations,
to J. D. Sim, Esq., Secretary to Government, Revenue Department.

Sir,

Ootacamund, 27 June 1862.

WITH reference to the order of Government, under date the 23d June 1862, I have the honour to inform you, with reference to the application of Mr. Lascelles for chinchona plants, that by the planting season next year, we will have available for distribution, probably, between 20,000 and 30,000 plants. In conversation, this gentleman mentioned 10,000 as the probable number of plants he intended to purchase: this quantity will, no doubt, be available for Mr. Lascelles, and will leave sufficient plants for the supply of other applicants.

— No. 103. —

Memorandum from W. G. McIvor, Esq., Superintendent Government Cinchona Plantations, Ootacamund, dated 6 September 1862.

1. I WOULD respectfully submit that the progress of the chinchona experimental cultivation, and the present very promising condition of the plants, are such as to justify more extended operations than those already proposed. I would therefore recommend that, in addition to the land (150 acres) proposed to be opened at Neddiwuttum during the present official year, a new plantation, of at least 100 acres, be opened to the east of the Pycara Waterfalls, as this is a site which will no doubt prove well suited for the cultivation of all the species

of cinchonas, and especially for the most valuable sorts, such as *C. succirubra*, *C. Calisaya*, and *C. Condaminea*. In opening this plantation, I would recommend that the land be cleared of forest and trenched—that is, in the first instance, lines of trenches to be made three feet wide and two feet deep, and ten feet apart, for the *C. succirubra* and *C. Calisaya*, and eight feet for *C. Condaminea*: this will leave an intervening space of five and seven feet in each row of untrenched land, which can be turned over after the planting is finished; or, perhaps, portions of it may be trenched over with the greatest advantage, immediately before the roots of the plants reach the untrenched land.

2. I would also submit, for the consideration of Government, that the pay of the office manager be increased from 40 to 50 rupees per mensem, and that the salary of the second writer be increased from 25 to 40 rupees, and that he be required to furnish security to the extent of 2,000 rupees, and to perform the duties of pay-clerk or shroff.

3. Subjoined is an estimate of the cost of this new work.

ESTIMATE COST of forming a Plantation (of 100 acres) of Chinchona Trees on the East of the Pycara Waterfalls.

PARTICULARS.	Cost of forming the Plantation with Buildings, Roads, Tools, &c.			Cost of Fixed Establishment.		
	Rs.	a.	p.	Rs.	a.	p.
<i>Building and other Contingent Charges:</i>						
To house for the assistant superintendent, to consist of two main rooms, 12 × 12, and four verandah rooms, 6 × 12. Walls to be built of burnt brick in clay. Fireplaces, chimneys, and corners of brick in chunam, and plastered with chunam; roof to be constructed of teakwood, king-beams, rafters of jungle-wood, and covered with thatch; doors and windows of teakwood - -	1,200	-	-	-	-	-
To out-houses, one kitchen, 10 × 12, and two out-houses, 10 × 15, constructed as above - - - - -	330	-	-	-	-	-
To tool-rooms and store-rooms, each 10 × 15, constructed as above - - - - -	250	-	-	-	-	-
To houses for 100 coolies, to consist of 30 rooms, 7 × 10 each constructed as above - - - - -	1,000	-	-	-	-	-
To enclosing 100 acres with strong wooden fence, five feet high - - - - -	750	-	-	-	-	-
To felling 100 acres, at 15 rupees per acre; lopping and clearing, at 15 rupees per acre; trenching 100 acres in lines, 3 feet wide, 2 feet deep, at 80 rupees per acre; shading plants, at 7 rupees per acre; carriage of plants and planting, at 6 rupees per acre - - - - -	12,300	-	-	-	-	-
To forming cart-roads, 12 feet wide, over 100 acres of land, at 300 rupees per mile - - - - -	1,350	-	-	-	-	-
To tools.—200 pickaxes, at 2 rupees each; 200 felling-axes, at 2 rupees each; 100 billhooks, at 1½ rupees each; 200 mamooties, at 1 rupee each; 12 steel digging-forks, at 4 rupees each; 24 steel spades, at 2 rupees each; 12 crowbars, at 3 rupees each - - - - -	1,282	-	-	-	-	-
A propagating-house - - - - -	2,000	-	-	-	-	-
Contingent charges, at 10 per cent. - - - - -	2,046	-	-	-	-	-
<i>Fixed Establishment:</i>						
1 Assistant superintendent - - - - -	-	-	-	125	-	-
2 Peons, at 7 rupees each per mensem - - - - -	-	-	-	14	-	-
TOTAL - - - - -	22,508	-	-	139	-	-

MINUTE by Sir *William Denison*.

I VISITED Neddiwuttum a few days ago, and found the state of the plantation to be as follows:—

1. At the top of the hill, a height of about 6,000 feet above the sea, a number of plants had been in the ground for upwards of a year; they had been exposed to the cold of the winter, the drought of the spring, the wet of the monsoon, yet nothing could look more healthy and flourishing than the whole of these. The tenderest species, *C. succirubra*, seemed to flourish best, for a plant not more than 15 months old was three feet six inches high. Farther down the hill a piece of ground, about 68 acres in extent, has been cleared and prepared for plants; this site occupied two sides of a valley, and was sheltered by belts of trees on the ridges, separating it from the adjacent valleys. About 18 acres of this were planted, and the plants looked healthy and flourishing. The planting had been delayed by the wet weather, but Mr. McIvor expected to plant at the rate of about 10 acres per week. In an adjacent valley, at a lower level, about 180 acres had been felled and partially burned, and below this again, was the propagating-house and the nursery for young plants. The permanent buildings for the coolies and superintendent had yet to be erected, and the fence round the plantation to be completed. Great credit, however, is due to Mr. McIvor, for the energy which he has shown in pushing on the experiment, and for the amount of work which he has got through; nothing can look better than the plants, and everything seems to me to testify to the success of the experiment. I should therefore be disposed to recommend that this should be pushed on steadily and regularly, and that 150 acres should be added annually to the plantations, for a period of nine or ten years at least, at the expiration of which period, we shall be able to ascertain whether Mr. McIvor's views as to the possibility of getting a return from the loppings and prunings of the trees, are correct. Should they be so, the size of the annual plantation may be diminished.

2. I have proposed to plant 150 acres annually, because I am of opinion that the Government will have to depend very much on its own exertions to provide chinchona bark to an extent at all commensurate with its consumption. It is perfectly true that many persons have asked for plants, and professed their intention of making plantations; but looking to the fact that they must, under any circumstances, remain without any interest upon their outlay for nine or ten years, and that this outlay will amount, with interest, to about 100 *l.* per acre, I do not think that any great extent of land will be planted. Should the lopping and pruning produce the quantity of bark anticipated by Mr. McIvor, the return will be sufficient to repay the capital expended in about 10 years, inclusive of interest; but the supply will not be large enough to produce any great effect on the market-price of quinine, which will go on increasing until the trees now planted arrive at their full growth, say 40 years, when the return might amount to 40,000 lbs. of bark per acre, or for 180 acres six millions of pounds. The cost to the Government would be at the utmost, supposing there to be no return in the interval, about 1,000 *l.* per acre, and the return, even at present prices, would be at least 16,000 *l.* per acre.

3. With reference to the accompanying proposal from Mr. McIvor, that he should be allowed to make a new plantation at Pycara, at a cost of 22,508 rupees, I should recommend that it be acceded to, to this extent—that he should be allowed to clear away the timber from 100 acres during the dry season, when alone it can be done with advantage, and that for this purpose he should be allowed to expend 3,000 rupees, while he should also be allowed to build a propagating-house and houses for the superintendent and the coolies, at a cost not exceeding 4,000 rupees; the remainder of the work to be included in the estimate for 1863-64, which must also include the completion of the plantations to the extent of 300 acres, and the clearance of the ground (150 acres) for the plantation of 1864-65. The other propositions of Mr. McIvor seem reasonable.

September 1862.

W. T. Denison.

ORDER of the Madras Government, 2 October 1862.

1. On a consideration of the President's minute above recorded, in which his Excellency has detailed the success of the cinchona plantation at Neddiwuttum, and has strongly recommended the gradual extension of these plantations, the Government resolve to sanction the proposal made by Mr. McIvor to form a new plantation at Pycara, at a total cost of 22,508 rupees; limiting, however, his operations during the current year to clearing away the timber from 100 acres during the dry season, when alone it can be done with advantage. To carry into effect this commencement of the new plantation, 3,000 rupees will be allotted to Mr. McIvor.

2. A further sum of 4,000 rupees will be allowed for building a propagating-house, and houses for the superintendent and coolies.

3. Mr. McIvor will make provision for the remainder of the work in framing the budget estimate for 1863-64, in which should also be included the completion of the plantation to the extent of 300 acres, and the clearing of 150 acres for the plantation of 1864-65.

4. The Government approve also of the proposal made by Mr. McIvor to increase the salaries of the office manager and of the second writer from 40 to 50 rupees, the second writer being required to furnish security to the extent of 2,000 rupees, and performing the duties of shroff. Application will, accordingly, be made to the Government of India for sanction to this increase of salaries.

5. Mr. McIvor will be called upon to report whether the additional expenditure sanctioned in this order can be met from the sums entered in the budget for 1862-63 for the cultivation of cinchona.

(signed) *T. Pycroft*,
Chief Secretary.

— No. 104. —

From the Government of Madras to Sir *Charles Wood*.

Madras, 23 October 1862.

1. WE have the honour to forward, for your information, papers regarding the cultivation of the chinchona on the Neilgherry Hills.

2. We beg to draw your attention especially to the Minute recorded by our President, after a personal inspection of the plantation at Neddivattum.

3. The following table shows the number of plants of each species on the 31st August last :—

Botanical Names.	Commercial Names.	Number of Original Plants and Date of Receipt.	Number of Plants on the 30th April 1862.	Number of Plants on the 31st August 1862.	Value per Pound of Dry Bark in the London Market.
					<i>s. d. s. d.</i>
1. <i>C. succirubra</i> - - -	Red Bark - -	457, April 1861	14,450	30,150	2 6 to 8 9
2. <i>C. Calisaya</i> - - -	Yellow Bark -	{ 6, April " } 48, Dec. " }	237	1,050	2 10 to 7 -
3. <i>C. Condaminea</i> , var. <i>Uritusinga</i> .	Original Loxa Bark	1, April 1862	1	41	2 10 to 7 -
4. <i>C. Condaminea</i> , var. <i>Chaharguera</i> .	Rusty Crown Bark	Seeds, Feb. "	8,000	20,030	2 10 to 7 -
5. <i>C. Condaminea</i> , var. <i>Crespilla</i>	Fine Crown Bark -	" Feb. "	105	236	2 10 to 6 -
6. <i>C. lancifolia</i> - - -	Pitayo Bark - -	4, Dec. 1861	1	1	1 8 to 2 10
7. <i>C. nitida</i> - - -	Genuine Grey Bark	Seeds, Feb. "	2,922	8,500	1 8 to 2 9
8. <i>C.</i> (species without name) -	Fine Grey Bark -	" Feb. "	1,211	2,440	1 8 to 2 10
9. <i>C. micrantha</i> - - -	Grey Bark - -	" Feb. "	3,786	7,400	1 8 to 2 9
10. <i>C. Peruviana</i> - - -	Finest Grey Bark -	" Feb. "	357	2,295	1 8 to 2 10
11. <i>C. Pahudiana</i> - - -	Unknown - -	250, Dec. "	425	425	Worthless.
TOTAL Number of Plants - - -		766	31,495	72,568	

Note.—Average present propagation, about 10,000 per mensem.

4. We

4. We need not comment on this table, which is enough in itself to show the great success attained in the propagation of the plant.

5. The Dodabetta plantation extends over 60 acres, of which 15 have been planted out, and 45 have been cleared and prepared in different stages. A further extent of 45 acres will be planted in the course of the current year. Of the entire area only five acres will be entirely cleared for the reception of plants, while 55 acres will retain various degrees of shade as an experimental measure.

6. The Neddiwuttum site comprises 150 acres, of which 21 have been planted, and 129 acres, more or less, prepared. A further extent of 79 acres will be planted in the course of the current calendar year. It is to this latter plantation that our President specially refers in his Minute, to which we have above called your attention; and we doubt not that you will be gratified to learn the flourishing condition of the plants generally, and in particular of six plants which were planted out experimentally on 29th September 1861, on the highest part of the site, about 6,200 feet above the sea. These plants (including the most delicate variety, *C. succirubra*) have stood the cold of the winter, the drought of the spring, and the wet of the monsoon without any artificial protection, and were in the most vigorous and healthy condition, ranging in height from 36 to 42 inches, although only 15 months old.

7. We do not deem it necessary to trouble you with any lengthened remarks on the difference of opinion between Dr. Anderson and Mr. McIvor as to the culture of the chinchona plant. The system adopted by Mr. McIvor is supported by Messrs. Markham, Cross, and Spruce, who alone have seen the plant growing in its natural habitat, is consistent with the recognised principles of horticulture, and, above all, has proved eminently successful in practice. Granting that the cultivation of the chinchona is still an experiment, it seems to us that we should be guilty of great want of judgment if we abandoned a system which has in every respect been attended with such satisfactory results. As already remarked, 55 acres of land are being tried with varying degrees of shade, in order that every mode of culture may be practically tested; but we are bound to say that, so far as our present experience extends, the plan of open planting has been most successful, the trees in open ground being far healthier and more vigorous than those under the shade of living trees, and this in proportion to their exposure to the influence of the atmosphere.

8. Mr. McIvor's mode of culture from the outset is explained in full detail in his report of the 31st May 1862, and we need only add that nothing can be more satisfactory or promising than its results.

9. The rapid propagation of plants has enabled us to offer a considerable number for sale early next year, at the moderate price of 4 annas (or 6d.) each. In fixing this rate, we have been influenced by a desire to encourage the cultivation of the plant by private individuals, owing to the expenses of cultivation, and the long period which must elapse before returns can be expected. We are not sanguine of the investment of private capital in this speculation, and therefore, while extending every legitimate encouragement to private enterprise, we purpose yearly to add to the Government plantations. We have directed Mr. McIvor to clear 100 acres, at a site differing in aspect from that at Neddiwattum, during the ensuing dry season (when alone this operation can be advantageously performed), and to build a propagating-house and quarters for the superintendent and coolies, at an aggregate cost of 7,000 rupees. The planting out of this new site will not be undertaken until 1863-64.

10. We consider that Mr. McIvor is entitled to very great credit for the able and energetic manner in which he has conducted the important experiment entrusted to him, and that he has well merited the increased salary allowed to him in modification of that proposed in our Order of 3d July 1861.

— No. 105. —

From *W. G. McIvor*, Esq., Superintendent Government Chinchona Plantations, Ootacamund, to *J. D. Sim*, Esq., Secretary to Government, Revenue Department, Fort St. George.

Sir, Ootacamund, 13 November 1862.

WITH reference to the Order of Government of the 22d ultimo, No. 2263, I have the honour to enclose the report for last month of our progress in the cinchona operations, and would add that we have begun the permanent build-ings both at Neddiwuttum and at Pycara, that upwards of 200 acres of forest have already been cleared for the next season's planting, which makes the total extent of our plantations, more or less prepared, 410 acres.

REPORT on the Number, Distribution, and Condition of the Chinchona Plants on the Neilgherries, on 31 October 1862.

No of Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Pound of Dry Bark in the London Market.	REMARKS.
				<i>s. d.</i> <i>s. d.</i>	
1	<i>C. succirubra</i> - -	Red Bark - -	39,268	2 6 to 8 9	1. The total number of plants placed out permanently in the plantations is 35,000 ; and although many of these were only recently transplanted, all are making satisfactory progress. 2. The increase by propagation during last month was 11,291, being considerably above the average of the last two months. 3. The <i>Chinchona lancifolia</i> continues to make satisfactory progress, and I believe it may be safely stated that the introduction of this valuable species is now secured.
2	<i>C. Calisaya</i> - -	Yellow Bark - -	1,346	2 10 to 7 -	
3	<i>C. Condaminea</i> , var. <i>Uritusinga</i> .	Original Loxa Bark -	820	2 10 to 7 -	
4	<i>C. Condaminea</i> , var. <i>Chaharguera</i> .	Rusty Crown Bark -	27,957	2 10 to 7 -	
5	<i>C. Condaminea</i> , var. <i>Crespilla</i> .	Fine Crown Bark -	287	2 10 to 6 -	
6	<i>C. lancifolia</i> - -	Pitayo Bark - -	1	1 8 to 2 10	
7	<i>C. nitidia</i> - -	Genuine Grey Bark -	8,542	1 8 to 2 9	
8	<i>C.</i> (species without name.)	Fine Grey Bark -	2,514	1 8 to 2 10	
9	<i>C. micrantha</i> - -	Grey Bark - -	8,110	1 8 to 2 9	
10	<i>C. Peruviana</i> - -	Finest Grey Bark -	2,477	1 8 to 2 10	
11	<i>C. Pahudiana</i> - -	Unknown - -	425	Worthless.	
TOTAL Number of Plants			91,747		

TABLE II.

MEMORANDUM of the Growth of the 11 Plants planted on the Second Denison Plantation at Neddiwuttum, on 30 August 1862.

Number of Plants.	Height in Inches when Planted 30 August 1862.	Height in Inches on 31 October 1862.	Growth in Inches during Two Months.	By whom Planted.
1	23	31	8	His Excellency Sir W. Denison.
2	16½	28	11½	
3	19	25	6	
4	15	23	8	
5	27	36	9	J. W. Breeks, Esq. - - Dr. Sanderson - - J. D. Sim, Esq. - - Lieutenant McLeod - - P. Grant, Esq. - -
6	20	28	8	
7	21	30	9	
8	18	28	10	
9	20	26	6	
10	20	32	12	
11	18	30	12	

Government Gardens, Ootacamund, 6 November 1862.

(signed) *W. G. McIvor*, Superintendent, Government Chinchona Plantations.

— No. 106. —

REPORT on the Number, Distribution, and Condition of the Chinchona Plants on the Neilgherries,
on the 30th November 1862.

No. of Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Pound of Dry Bark in the London Market.		REMARKS.
				s. d.	s. d.	
1	C. succirubra - -	Red Bark - -	42,184	2 6	to 8 9	During last month, no plants having been placed out in the plantations, therefore the number of plants permanently planted out is the same as in October, namely, 35,000, all of which are making very satisfactory progress.
2	C. Calisaya - -	Yellow Bark - -	1,372	2 10	to 7 -	
3	C. Condaminea, var. Uritusinga.	Original Loxa Bark -	850	2 10	to 7 -	
4	C. Condaminea, var. Chahuarguera.	Rusty Crown Bark -	37,781	2 10	to 7 -	
5	C. Condaminea, var. Crespilla.	Fine Crown Bark -	464	2 10	to 6 -	
6	C. lancifolia - -	Pitayo Bark - -	1	1 8	to 2 10	The average growth of last month, as will be observed by Table II., is 6½ inches, which exceeds the average growth of September and October by two inches.
7	C. nitida - -	Genuine Grey Bark -	8,565	1 8	to 2 9	
8	C. species without name.	Fine Grey Bark -	2,542	1 8	to 2 10	
9	C. micrantha - -	Grey Bark - -	8,148	1 8	to 2 9	
10	C. Peruviana - -	Finest Grey Bark -	2,594	1 8	to 2 10	
11	C. Pahudiana - -	Unknown - -	425	Worthless.		
TOTAL Number of Plants - - -			104,926			

TABLE II.

MEMORANDUM of the Growth of the Eleven Plants, planted on the Second Denison Plantation, at Neddiwuttum, on the 30th August 1862.

Number of Plants.	Height in Inches when Planted, 30th August 1862.	Height in Inches on the 31st October 1862.	Height in Inches on the 30th November 1862.	Growth in Inches during November 1862.	By whom Planted.
1	23	31	38	7	His Excellency Sir W. Denison.
2	16½	28	33	5	
3	19	25	31	6	
4	15	23	32	9	
5	27	36	43	7	
6	20	28	34	6	
7	21	30	35	5	J. W. Brecks, Esq.
8	18	28	35	7	Dr. Sanderson.
9	20	26	32	6	J. D. Sim, Esq.
10	20	32	39	7	Lieutenant McLeod.
11	18	30	37	7	P. Grant, Esq.

The increase by propagation during the month is 13,179, which considerably exceeds the results obtained in any previous months. The largest plant we possess is now 6 ft. 9 in. high, with branches from three to five feet in length; the stem, measured at half a foot above the ground, is 5½ inches.

— No. 107. —

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on
31 December 1862.

No. of Species.	Botanical Names.	Commercial Names.	Number of Plants.	Value per Pound of Dry Bark in the London Market.	REMARKS.
				s. d. s. d.	
1	<i>C. succirubra</i> - -	Red Bark - -	45,352	2 6 to 8 9	The planting season having passed, the number of plants placed out in the plantations remain as in October, namely 35,000; these are now well established, and are making satisfactory progress.
2	<i>C. Calisaya</i> - -	Yellow Bark - -	1,448	2 10 to 7 -	
3	<i>C. Condaminea</i> , var. <i>Uritusinga</i> .	Original Loxa Bark -	872	2 10 to 7 -	
4	<i>C. Condaminea</i> , var. <i>Chahuarguera</i> .	Rusty Crown Bark -	46,751	2 10 to 7 -	The increase by propagation during last month is 12,780, being a little above the average results obtained during the last six months.
5	<i>C. Condaminea</i> , var. <i>Crespilla</i> .	Fine Crown Bark -	664	2 10 to 6 -	
6	<i>C. lancifolia</i> - -	Pitayo Bark - -	1	1 8 to 2 10	
7	<i>C. nitida</i> - -	Genuine Grey Bark -	8,591	1 8 to 2 9	
8	<i>C. species</i> without name.	Fine Grey Bark -	2,569	1 8 to 2 10	
9	<i>C. micrantha</i> - -	Grey Bark - -	8,304	1 8 to 2 9	
10	<i>C. Peruviana</i> - -	Finest Grey Bark -	2,729	1 8 to 2 10	
11	<i>C. Pahudiana</i> - -	Unknown - -	425	Worthless.	
TOTAL Number of Plants - - -			117,706		

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation at Neddiwuttum, on 30 August 1862.

Number of Plants.	Height in Inches when Planted, 30 August 1862.	Height in Inches on 30 November 1862.	Height in Inches on 31 December 1862.	Growth in Inches during December 1862.	By whom Planted.
1	23	38	41	3	His Excellency Sir W. Denison.
2	16½	33	37	4	
3	19	31	34	3	
4	15	32	36	4	
5	27	43	48	5	
6	20	34	40	6	
7	21	35	38	3	J. W. Brecks, Esq.
8	18	35	37	2	Dr. Sanderson.
9	20	32	38	6	J. D. Sim, Esq.
10	20	39	42	3	Lieutenant McLeod.
11	18	37	42	5	P. Grant, Esq.

Table II. exhibits the growth of 11 plants, planted out by his Excellency the Governor and other gentlemen on the 30th August 1862; the average growth of these plants for last month being only four inches, or two-and-a-half inches less than in November. This growth is, however, considerable, as December is one of the coldest months in the year, and the season at which most plants begin to winter. The whole of the plants in the nurseries and propagating houses continue in fine health.

— No. 108 A. —

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on
31 January 1863.

No. of Species.	Botanical Names.	Commercial Names.	No. of Plants.	Value per Pound of Dry Bark in the London Market.		REMARKS.
				s. d.	s. d.	
1	C. succirubra - -	Red Bark - -	47,507	2 6	to 8 9	The total number of plants planted out permanently in the plantations remain as formerly, namely 35,000. These continue to make very satisfactory progress, having now passed through the month of January, the driest and coldest in the year, not only without injury, but their growth has scarcely been retarded by the cold and drought. It may therefore be concluded that our dry and cold season on the Neilgherries will not form any impediment to the successful cultivation of cinchonas.
2	C. Calisaya - -	Yellow Bark - -	1,424	2 10	to 7 -	
3	C. Condaminea, var. Uritusinga.	Original Loxa Bark -	891	2 10	to 7 -	
4	C. Condaminea, var. Chahuarguera.	Rusty Crown Bark -	54,790	2 10	to 7 -	
5	C. Condaminea, var. Crespilla.	Fine Crown Bark -	789	2 10	to 6 -	
6	C. lancifolia - -	Pitayo Bark - -	1	1 8	to 2 10	
7	C. nitida - -	Genuine Grey Bark -	8,296	1 8	to 2 9	
8	C. species without name.	Fine Grey Bark -	2,579	1 8	to 2 10	
9	C. micrantha - -	Grey Bark - -	8,247	1 8	to 2 9	
10	C. Peruviana - -	Finest Grey Bark -	2,772	1 8	to 2 10	
11	C. Pahudiana - -	Unknown - -	425	Worthless.		
TOTAL Number of Plants - - -			127,671			The increase by propagation during last month is 11,689, being rather under the average results of the last six months. Deducting the plants sent to Bengal and elsewhere, together with the number lost in transplanting, gives the total number of plants at present 127,671.

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. Succirubra*, planted on
the Second Denison Plantation at Neddiwuttum, on 30 August 1862.

Number of Plants.	Height in Inches when Planted, 30 August 1862.	Height in Inches on 31 December 1862.	Height in Inches on 31 January 1863.	Growth in Inches during January 1863.	By whom Planted.
1	23	41	45	4	His Excellency Sir W. Denison.
2	16½	37	40	3	
3	19	34	38	4	
4	15	36	40	4	
5	27	48	52	4	
6	20	40	41	1	
7	21	38	41	3	J. W. Brecks, Esq.
8	18	37	40	3	Dr. Sanderssn.
9	20	38	40	2	J. D. Sim, Esq.
10	20	42	48	6	Lieutenant McLeod.
11	18	42	46	4	P. Grant, Esq.

Table II. exhibits the growth of 11 plants, planted out by his Excellency the Governor and other gentlemen on the 30th August 1862, the average growth of these plants for last month being about 3½ inches, or half an inch less than in December; but when it is considered that a maximum growth of six inches was obtained in this month, it will be observed how little effect our dry and cold season has on the plants.

(signed) W. G. McIvor,
Superintendent Government Chinchona Plantations.

— No. 108 B.—

REPORT on the Number, Distribution, and Condition of Chinchona Plants on the Neilgherries, on 28 February 1863.

No. of Species.	Botanical Names.	Commercial Names.	No. of Plants.	Value per Pound of Dry Bark in the London Market.		REMARKS.
				s. d.	s. d.	
1	C. succirubra - -	Red Bark - -	48,989	2	6 to 8	The total number of plants planted out permanently in the plantations remain as formerly, namely, 35,000. These plants have now passed through the dry and cold season in the most satisfactory manner; the weather now becoming mild, with appearance of rain, indicating the close of the winter season. The increase by propagation during last month is 8,068, being about 3,500 plants under the average results of the last six months, this reduction being caused by the want of space to harden off the plants.
2	C. Calisaya - -	Yellow Bark - -	1,480	2	10 to 7	
3	C. Uritusinga - -	Original Loxa Bark -	927	2	10 to 7	
4	C. Condaminea - -	Select Crown Bark -	51,012	2	10 to 7	
5	C. Crespilla - -	Fine Crown Bark -	825	2	10 to 6	
6	C. lancifolia - -	Pitayo Bark - -	1	1	8 to 2	
7	C. nitida - -	Genuine Grey Bark -	8,312	1	8 to 2	
8	C. species without name.	Fine Grey Bark -	2,595	1	8 to 2	
9	C. micrantha - -	Grey Bark - -	8,326	1	8 to 2	
10	C. Peruviana - -	Finest Grey Bark -	2,847	1	8 to 2	
11	C. Pahudiana - -	Unknown - -	425	Worthless.		
TOTAL Number of Plants - - -			135,739			

TABLE II.

MEMORANDUM of the Growth of Eleven Plants of *C. succirubra*, planted on the Second Denison Plantation at Neddiwuttum, on 30 August 1862.

Number of Plants.	Height in Inches when Planted, 30 August 1862.	Height in Inches on 31 January 1863	Height in Inches on 8 February 1863.	Growth in Inches during February 1863.	By whom Planted.
1	23	45	48	3	His Excellency Sir W. Denison.
2	16½	40	44	4	
3	19	38	41	3	
4	15	40	43	3	
5	27	52	54	2	
6	20	41	43½	2½	J. W. Breeks, Esq. Dr. Sanderson. J. D. Sim, Esq. Lieutenant McLeod. P. Grant, Esq.
7	21	41	44½	3½	
8	18	40	44	4	
9	20	40	42	2	
10	20	48	51	3	
11	18	46	52	6	

Table II. exhibits the growth of 11 plants planted out by his Excellency the Governor and other gentlemen on the 30th August 1862, the average growth of these plants during last month being 3½ inches, or a quarter of an inch less than in January, which, allowing for the shortness of the month of February, gives merely the same results. The height of the largest plant we possess is now 7 feet 2 inches, with branches from 3 to 5½ feet in length. The stem, measured half a foot from the ground, is 5¼ of an inch in circumference.

(signed) W. G. McIvor.
Superintendent Government Chinchona Plantations.

APPLICATIONS for CHINCHONA PLANTS.

	No.
G. Dawson, Esq. - - - - Ootacamund - - - -	1,000
J. Chesson, Esq. - - - - Mahableshtar - - - -	500
W. Chambers, Esq. - - - - Ootacamund - - - -	1,000
A. R. Lascelles, Esq. - - - - Ootacamund - - - -	10,000
T. De Facien, Esq. - - - - Kattarey - - - -	5,000
C. Vincent, Esq. - - - - Kattarey - - - -	5,000
J. Pierie, Esq. - - - - Calicut - - - -	2,000
W. Stainbank, Esq. - - - - Hullikul - - - -	1,000
J. H. Schnarrie, Esq. - - - - Ootacamund - - - -	5,000
W. Southey, Esq. - - - - Wallaghaut - - - -	1,700
E. T. FitzGerald, Esq. - - - - Calcutta - - - -	800
Major Morgan - - - - Ootacamund - - - -	1,000
TOTAL - - - -	<u>34,000</u>

MEMORANDUM of CHINCHONA PLANTS DISTRIBUTED.

F. N. Maltby, Esq. - - - - Travancore - - - -	16
Dr. Junghuhn - - - - Java - - - -	56
A. R. Lascelles, Esq. - - - - Ootacamund - - - -	12
M. Anderson, Esq. - - - - Jamaica - - - -	2
Dr. Wiehe - - - - Bombay - - - -	10
Dr. T. Anderson - - - - Calcutta - - - -	554
Dr. Jamieson - - - - Saharunpore - - - -	107
Professor Lees - - - - Calcutta - - - -	61
Rajah of Travancore - - - - - - - -	521
TOTAL - - - -	<u>1,339</u>

— No. 109. —

MEMORANDUM by Mr. Markham.

(Sent to Mr. McIvor, *via* Southampton, 19 February 1863.)

THERE has been much confusion in the nomenclature of the species of chinchona from the forests of Loxa, three varieties of which are now growing on the Neilgherry Hills. They are all classed by Dr. Weddell under the head of *C. Condaminea*, and hitherto the varieties have been called, in Mr. McIvor's Reports—1. *Uritusinga*. 2. *Chahuarguera*. 3. *Crispa*.

Dr. Hooker, in a recent number of the "Botanical Magazine," has named the species *C. officinalis*, reverting to the original name given by Linnæus. Dr. Hooker says: "When once the law of priority is departed from without perfectly good cause, the door is opened to endless future change, and consequent confusion. The genus was founded upon the one plant called 'quinquina,' by La Condamine, to which Linnæus gave the specific name of *C. officinalis*. This name, which appears to us in every way unobjectionable, and which was adopted by Vahl and Lambert, Willdenow, Lamarck and Rœmer, and Schultes, was changed by Humboldt and Bonpland to *C. Condaminea*, on grounds which we consider insufficient."

It is, therefore, proposed that the name of *C. officinalis* should be adopted for this species now thriving in India, out of deference to the opinion of so high an authority on systematic botany as Dr. Hooker.

With regard to the three varieties of this species now growing on the Neilgherry Hills, it is proposed to adopt the following names, with the concurrence of Sir William and Dr. Hooker:—

1. That now called *Uritusinga* was the original variety discovered by La Condamine, and it should therefore bear his name, var. *Condaminea*.

2. That now called *Chahuarguera* is the identical plant figured in Plate X. of the great work of Humboldt and Bonpland (the unshaded branch with capsules). It ought, therefore, to bear the name of one or other of those eminent naturalists. A species of chinchona has already been called after Humboldt, and it is, therefore, proposed to call this variety *Bonplandiana*.

3. The variety *crispa* of Tafalla requires no alteration.

We have, therefore—

- C. officinalis* 1. Var. *Condaminea*.
2. Var. *Bonplandiana*.
3. Var. *crispa*.

Clements R. Markham.

18 February 1863.

— No. 110. —

From the Secretary of State for India to His Excellency the Honourable the Governor in Council, Fort St. George.

Sir,

India Office, London, 2 January 1863.

Para. 1. I HAVE considered in Council your letters, in the Revenue Department, dated October 10th (No. 73), October 23d (No. 75), and November 18th (No. 82) 1862, transmitting the proceedings of your Government connected with the cultivation of chinchona plants on the Neilgherry Hills.

2. The complete success which has hitherto attended this important experiment is very satisfactory, and I am of opinion that it has now reached a stage at which it has become necessary to take effective steps both to ensure the steady annual increase of the area of the Government plantations in the Neilgherries, and the introduction of the chinchona into other hill districts.

3. I, therefore, approve of your resolution to plant 150 acres annually, for at least 10 years, so that, at the end of that period, there may be a prospect of obtaining a very large harvest of quinine-yielding bark. No return can be expected

expected before that time, so far as bark is concerned; but I take this opportunity of calling your attention to the supplement to the "Calcutta Gazette" of October 15th (No. 54) 1862, in which it is stated that an infusion of the leaves of *C. succirubra*, which had spontaneously fallen from plants in the Darjeeling nursery in June and July, had been administered to patients suffering from intermittent fever, who were cured without any other medicine whatever. If the cinchona leaves can thus be turned to account, a return on the outlay may be obtained almost immediately, while great additional benefit will be derived from the cultivation of the plants. The medicinal properties of the leaves can be tested on a very much larger scale in your Presidency than at Darjeeling, and I desire that measures may be taken for obtaining an analysis of the leaves, and that a supply may be sent to some one of the Government hospitals for trial.

4. Chinchona cultivation should be introduced into the other hill districts of your Presidency, as well as into Coorg. The two great objects of the experiment are—the provision of an abundant and certain supply of bark for the use of hospitals and troops, and the spread of the cultivation throughout the hill districts, in order to bring the remedy within the reach of frequenters of jungles, and of the native population generally. Your Government has very justly observed that "the experiment cannot be regarded as a mere money speculation," nor are the commercial advantages that may be derived from it to be considered as other than a secondary consideration; though of course a return for the outlay, and the spread of chinchona cultivation by private enterprise, are very desirable in themselves.

5. The Collectors of Coimbatore and Madura, in concert with Mr. McIvor, should be directed to take the earliest opportunities that offer, of introducing chinchona cultivation into the hill districts of their collectorates; and a request to the same effect should be sent to the Commissioner of Mysore, with respect to Coorg, where there are many coffee planters who would doubtless be willing to undertake this cultivation.

6. Your resolution to offer a certain number of plants for sale every year, at a moderate price, will have the important effect of extending the cultivation over a wider area. Two companies have already been formed in London, for the object of cultivating chinchona, in combination with coffee and tea, in the Western Neilgherries and Wynaad; and I observe that Mr. Lascelles, the agent of one of these companies, has already bespoken 10,000 out of the 20,000 plants which are to be sold this year. Chinchona, when grown together with coffee, is likely to be a profitable investment, especially if the leaves can be turned to account, notwithstanding the greater length of time that must elapse before any profit can be expected from the former. I am, therefore, inclined to take a more hopeful view of the prospect of capital being invested in this speculation than your Government has been able to do; and I desire that every legitimate encouragement may be extended to individuals or companies who may undertake chinchona cultivation.

7. I cordially approve of the increase of salary which you have allowed to Mr. McIvor, to whose great skill as a propagator, and zeal and intelligence in superintending the experiment, the success which has now been attained is mainly due.

8. The monthly reports from the superintendent of chinchona plantations should be transmitted to me as soon after receipt as possible, and, in addition to the number and condition of the plants and the area under cultivation, they should also contain information respecting the number of plants sold or otherwise disposed of, the localities to which they are sent, and the prospects of cinchona cultivation by private enterprise.

9. In your letter, dated October 10th (No. 73) 1862, you report the dismissal of the gardener Lyall. In the accompanying papers there is sufficient evidence of negligence and insubordination on his part to justify his dismissal, and I must, therefore, express the opinion that the lenity with which he has been treated was wholly undeserved.

— No. 111. —

From *Herman Merivale*, Esq., c.b., to *J. E. Howard*, Esq.

Sir,

India Office, 16 June 1862.

I AM desired by the Secretary of State for India in Council to convey to you his best thanks for your valuable present of a fine plant of *Chinchona Uritu-singa*, which will be a very important addition to the number of quinine-yielding species of chinchona plants already acclimatized in the Neilgherry Hills.

Sir Charles Wood has much pleasure in being able to inform you, although, through the carelessness of the railway authorities at Avenashy, the plant suffered very severely in its transit across the hot plains, that it has recovered from the damage it then received since its arrival in the Neilgherry Hills, and that it is now considered to be safe.

J. E. Howard, Esq.,
2, Lordship-lane, Tottenham, N.

I have, &c.
(signed) *Herman Merivale*.

— No. 112. —

MEMORANDUM by Mr. *Markham*.

India Office, 17 June 1862.

I HAVE on several occasions explained the reasons which make it important to introduce the *C. lancifolia* of New Granada into India, the only valuable species of chinchona which has not been established there. I would now propose that I should be authorised to employ the gardener Cross, who is now in South America, to procure a supply of seeds of this species. I have great confidence that he will do his work thoroughly and expeditiously, as well as economically. Last autumn he overcame great difficulties in procuring seeds of *C. Condaminea* near Loxa, and got a large supply of the best varieties, which were in excellent order on arriving in India, and came up by thousands. *C. lancifolia* and other valuable kinds in New Granada are important; they thrive at very great altitudes, and yield the alkaloid called chinchonidine as well as quinine.

Clements R. Markham.

Note.—Mr. Markham's proposal was approved by the Secretary of State in Council on 20th June 1862.

— No. 113. —

From Sir *C. Wood* to Lord *Elgin*.

My Lord,

India Office, London, 24 January 1863.

Para. 1. WITH reference to my Despatch, dated 31st May 1862 (No. 48), I now transmit a translated extract from a number of the "Flora," a German botanical periodical (together with the original), containing letters from M. Hasskarl, the gentleman formerly in charge of the chinchona culture in Java, by which it appears that, owing to the unfavourable reports of scientific men in Holland, the Government of Netherlands India have determined to put an entire stop to the further cultivation of *Chinchona pahudiana* plants in Java.

2. M. Hasskarl was the introducer of this species from South America.

3. Under these circumstances, it does not appear to me advisable that any further expense should be incurred in the cultivation of this species in Darjeeling.

4. I have

4. I have perused with interest Dr. Anderson's letter, in the supplement to the "Calcutta Gazette" of 15th October 1862 (No. 54), in which he reports that four cases of intermittent fever have actually been cured by the use of an infusion of chinchona leaves without any other medicine whatever. I desire that any reports from Dr. Anderson on the progress of the experimental cultivation of chinchona plants may be transmitted to me without delay, as well as any accounts of the chemical analysis of chinchona leaves, or bark, which you may receive from the Chemical Examiner to your Government.

His Excellency
The Right Hon. the Governor General
of India in Council.

I have, &c.
(signed) C. Wood.

Enclosure in No. 113.

EXTRACT from No. 21 of the "Flora" of 1862, a German Periodical published at Ratisbon, on the Cultivation of Chinchona in Java.

WITH reference to what was said last year in this Paper (pp. 224 and 608, &c.), I should not withhold from your readers the decision of the Minister of the Colonies, in the Second Chamber of the Dutch States General, in reference to this culture. A doubt had been expressed whether, in the great spread of chinchona cultivation, a wrong method might not have been adopted; and the Minister replied:—

"The belief that the culture of the least valuable species of cinchona would be useful and profitable, is the reason that so many trees have been grown in Java, of the kind first known as *C. ovata*, then as *C. lucumæfolia*, and now as *C. Pahudiana*. A tree of this species has been chemically analyzed by Professors G. F. Mulder, and F. A. W. Miquel; and in consequence of the joint report of these gentlemen, the Indian Government have determined to put an entire stop to the further cultivation of *C. Pahudiana*. At the same time, the Governor General has considered whether it will be advisable for the Government to continue the chinchona cultivation, or whether the time has come for handing it over to private enterprise."

(signed) Dr. J. K. Hasskarl.

Königswinter, 23 May 1862.

THE following is from the "Nieuwen Amsterdamsch Handelsen Effectenblad," No. 151,
2 June 1862:—

IN the sitting of the Second Chamber, the question was brought forward, whether it would be advisable to leave the culture of the chinchona to private enterprise; and I may be permitted, with modesty, to give my opinion on this subject.

It would appear to me, that the culture must be undertaken by Government, to whom it is not essential that the return should be rapid. It appears that the chemical researches of Messrs. Mulder and Miquel do not support those of Dr. De Vrij (given in the "Batavischen Handelsblat" of 14th September 1861, p. 607, &c.), and in this case the hope of chinchona cultivation being undertaken by private enterprise disappears.

(signed) J. K. Hasskarl.

— No. 114. —

REPORT on the Botanical Gardens, Calcutta, from April 1861, to April 1862,
by T. Anderson, Esq., M.D.

(EXTRACT).

THE most important event in the history of the Botanic Gardens for the past year, is the share the gardens have had in the introduction of the quinine-yielding *Chinchona* into India. I was directed last September to proceed to Java, *via* Singapore, to procure plants and seed of the species of cinchona cultivated by the Dutch; also to examine the method of cultivation adopted in that island, and afterwards to proceed to Madras to report on the prospects of the success of the experiment of cultivating the chinchona in the Neilgherries. The results of this mission are fully detailed in my report to the Government of India. I

derived great assistance from the varied resources of the Botanic Gardens, in carrying out my operations connected with this important subject. The native gardeners that accompanied me were lent from the Botanic Gardens, as also were the Wardian cases for the transport of the plants.

The chinchona plants were brought to Calcutta from Java, before they were taken to Madras. During the 14 days they remained in Calcutta, they were so carefully tended by Mr. Scott that, when they reached their destination at Ootacamund, only a mortality of one per cent. had occurred during the entire period spent on the journey from Java to the Neilgherries. While I was in Calcutta, before proceeding to Madras, I received the sanction of Lord Canning to a proposal to commence the cultivation of chinchona in the mountains of the Bengal Presidency; and, as a nucleus of this cultivation, I was authorised to leave a few plants of *Chinchona Calisaya* and *C. Pahudiana* in the Botanic Gardens, pending arrangements for their final destination. This occurred in the beginning of December. While I was at Ootacamund, I procured 204 plants belonging to four other species of chinchona besides those I obtained in Java. Several of these plants were destroyed between the foot of the Neilgherries and the railway station, by the upsetting of one of the carts on which the Wardian cases were carried. The remainder of these plants reached the Botanic Gardens on the 13th January 1862. On my return from Madras, I found that some seeds of *Chinchona Pahudiana*, sown during my absence, had germinated to the number of 548. In the report of last year, I mentioned the germination of seeds of species of chinchona brought by me from England. About 120 of these seeds had grown by the end of May 1861, but during the hot period between that time and the middle of October, many of the young plants died. On the approach of the cold weather, all the remaining seedlings, more or less, recovered; while four young plants of the red bark (*Chinchona succirubra*) grew rapidly. Of the chinchona plants raised in the Botanic Gardens, 31 plants remained on the 19th January 1862. The seeds I distributed in March 1861 germinated only at Ootacamund, and at Peradenia, the Botanic Garden of Ceylon. The following table shows the number of plants collected in the Botanic Gardens, Calcutta, on the 19th January 1862, as the commencement of the experiment in Bengal:—

TABLE showing the Number of each Species of Chinchona in the Botanic Gardens, Calcutta, on 19th January 1862.

	From Ootacamund.	Raised in Botanic Gardens, Calcutta.	From Java.	TOTAL.
<i>C. succirubra</i> - - - -	87	4	- -	91
<i>C. Calisaya</i> - - - -	-	-	6	6
<i>C. nitida</i> - - - -	56	11	- -	67
<i>C. micrantha</i> - - - -	43	13	- -	56
<i>C. Peruviana</i> - - - -	4	1	- -	5
<i>C. Pahudiana</i> - - - -	-	-	59	59
<i>C. species ignot</i> - - - -	3	2	- -	5
GRAND TOTAL of Chinchona Plants in the Botanic Gardens, Calcutta, on 19th February 1862 -				289

On my return to Calcutta from Madras, I received permission to commence the cultivation of the chinchona near Darjeeling. I was, however, not able to leave Calcutta until the 25th March, being detained by my duties as Professor of Botany at the Medical College.

During this time, the chinchona plants suffered considerably, and a few died—in all, 34.

I engaged

I engaged the services of Mr. T. Stubbs, a European gardener in charge of the cultivation, and on the 25th March, I sent him to Darjeeling in charge of the following number of plants :—

NUMBER and species of Plants of Chinchona sent from the Botanic Gardens, Calcutta, to Darjeeling, on 25 March 1862, in 13 Wardian Cases.

NAMES OF SPECIES.										Number of Species
<i>C. succirubra</i>	-	-	-	-	-	-	-	-	-	84
<i>C. Calisaya</i>	-	-	-	-	-	-	-	-	-	5
<i>C. nitida</i>	-	-	-	-	-	-	-	-	-	56
<i>C. micrantha</i>	-	-	-	-	-	-	-	-	-	42
<i>C. Peruviana</i>	-	-	-	-	-	-	-	-	-	2
<i>C. Pahudiana</i>	-	-	-	-	-	-	-	-	-	54
Seedlings of ditto	-	-	-	-	-	-	-	-	-	548
Species ignota	-	-	-	-	-	-	-	-	-	6
GRAND TOTAL of Species sent to Darjeeling - -										797

Encouraged by the successful keeping of so many plants of chinchona in the climate of Calcutta for so many months, I was induced to test the effects of the climate on some of the species by a more prolonged trial. With this intention, I left two well-grown plants of *C. succirubra*, and four of *C. Pahudiana*, in the Botanic Gardens of Calcutta; and I gave directions that they should receive no more than the ordinary care bestowed on the other plants in the garden. Besides these plants, I was obliged to leave 14 cuttings of *C. succirubra*, three of *C. nitida*, and one of *C. micrantha* in the propagating beds of the Botanic Gardens.

The 13 Wardian cases containing chinchona plants were taken by railway to Sahebgunge, from whence, after a delay of two days, they were removed to Caragolah Ghaut in the small steamer. On the 29th March, the plants were transported by coolies to Purneah, but though the distance is only 24 miles, the difficulties attending the moving of such heavy cases were so great, that several of them were nearly 48 hours in arriving at Purneah, and they all suffered much from exposure to the sun. On the 1st April, the cases were still detained at Purneah for want of carriage.

— No. 115. —

REPORT on the Experimental Cultivation of the Quiniferous Chinchonæ in British Sikhim.

From *T. Anderson, Esq., M.D.*, Officiating Superintendent, Botanic Gardens, Calcutta, to *H. Bell, Esq.*, Under Secretary to the Government of Bengal.

Sir,

Darjeeling, 6 August 1862.

I HAVE the honour to submit a report on the experiment of cultivating the Quiniferous Chinchonæ, in British Sikhim, from the 24th March until the 1st August. The report shows that the experiment was actually commenced on the 27th May, on which day there were 211 plants of the different species of chinchona, and that on the 1st August there were in all 1,611 plants in the nursery.

REPORT on the Cultivation of the Quiniferous Chinchonæ, in British Sikhim, from the 24th March to the 1st August 1862.

THE plants of cinchona which had been collected in the Botanic Gardens, Calcutta, from Java and Ootacamund, as well as those raised from seeds in the Botanic Gardens during the previous year, were sent by railway to Sahebgunge on the 24th March, in charge of Mr. Thomas Stubbs, a European gardener, accompanied by two Mallees from the Botanic Gardens. All the plants were contained in thirteen Wardian cases. Some of the plants were in earthen, others in Bamboo pots; almost all those of *Chinchona succirubra* were planted in the soil contained in the cases. The following table shows the number of plants of each species despatched from Calcutta on the above date:—

TABLE, No. I, showing the Number of Species of Chinchona sent to Darjeeling on 24th March 1862.

NAME of SPECIES.	No. of Plants.	No. of Seedlings.	Total of Plants and Seedlings.
<i>Chinchona succirubra</i> - - - - -	84	—	84
„ <i>Calisaya</i> - - - - -	5	—	5
„ <i>nitida</i> - - - - -	56	—	56
„ <i>micrantha</i> - - - - -	42	—	42
„ <i>Peruviana</i> - - - - -	2	—	2
„ <i>Pahudiana</i> - - - - -	54	548	602
„ <i>species ignota</i> - - - - -	6	—	6
GRAND TOTAL - - - - -	249	548	797

No delay occurred at Sahebgunge; the plants were taken by the small ferry steamer across the Ganges to Caragolah Ghaut. They remained there until the afternoon of the 29th March. The distance from Caragolah Ghaut to Purneah, 24 miles, was performed very slowly. Some of the Wardian cases started from Caragolah on the afternoon of the 29th, not arriving at Purneah till noon on the 31st. This delay was caused by the inefficient coolies provided for the transport of the cases. Many of them were children of 12 and 14 years of age, who were not even tall enough to lift the cases from the ground. The result was that 18 hours after the plants had started from Caragolah Ghaut, I found two of the cases at distances of four and six miles from Caragolah Ghaut fully exposed to the burning heat of the sun, the coolies lying by them completely exhausted. Two carts were procured from a neighbouring village, but this means of conveyance was so slow that 20 hours more elapsed before the cases reached Purneah. The plants arrived flaccid and drooping from the effects of the exposure and the jolting; but, with a single exception, they all recovered before they left Purneah. At Purneah some delay occurred, but this I did not regret, as Mr. Robinson availed himself of it to procure a party of strong Dhanga coolies, who most materially assisted in getting the cases over the next long stage of 40 miles to Kissengunge. The cases left Purneah on the 1st April, and arrived at Kissengunge on the evening of the 2nd. They reached Punka-barree, at the foot of the hills, on the 7th April, four days after leaving Kissengunge. After two days the plants were removed to Kursiong, which I had fixed on as the most suitable place for keeping them until arrangements could be made for their final disposal. The cases reached Kursiong on the 9th, and were at once placed in the square of the barracks used as rest houses for the European troops

troops proceeding to Darjeeling. These barracks are about 4,500 feet above the level of the sea. When the plants were carefully examined, on their arrival at Kursiong, eight were found to have perished since their departure from Calcutta. This is exclusive of casualties among the seedlings of *C. Pahudiana*. I look on this as a very small mortality, considering what the plants had undergone since leaving Calcutta. Mr. Stubbs deserves great credit for the unremitting attention he bestowed on the plants, and for the care with which he carried out my orders to give the plants as much air and as little water as possible. The exposure of the plants to air and light, and all changes of the weather was commenced soon after their arrival at Kursiong, and, after a few days' gradual inuring, they were left exposed night and day with great benefit to all the species.

While the chinchona plants were left at Kursiong, under the care of Mr. Stubbs, I was engaged in exploring the forests, in the neighbourhood of Darjeeling, for a suitable site for the permanent nursery. I hoped to procure land near enough to Darjeeling to allow of the permanent propagating house and a temporary dwelling for the European gardener being erected within two months. This I soon discovered was quite impossible, as all the land within several miles of Darjeeling had been purchased for the cultivation of tea, and that whatever piece of Government land I might select, a new road must be made to it before any buildings could be commenced. The nearest and most suitable tract of land I could obtain lay on the slopes of Sinchal, extending to the river Teesta, and which contained suitable land from heights of from 800 feet above the sea to 8,600, the summit of Sinchal. The nearest point of this tract which had not been acquired by private individuals was not less than 10 miles from Darjeeling, and was quite inaccessible from the dense forest with which it was covered. I was thus forced to seek for some temporary accommodation for the chinchona plants. After consulting with Captain Fitzgerald, the Executive Engineer, it was agreed that the best plan would be to convert one of the empty officers' quarters at Sinchal into a temporary propagating house, and to make over another as the dwelling-house of the European gardener. Two rooms were accordingly thrown into one, and a glazed roof substituted for the wooden one. A plan for heating the atmosphere of the house, and for affording bottom heat to the plants was contrived. This was done by blocking up the chimney of the room, and carrying the smoke and heated air through a horizontal flue of masonry, which, after passing through the room, ends in a short chimney outside. The plants were brought to Sinchal on the 5th May; they suffered more during the short journey of 20 miles from Kursiong to Sinchal than they did on the way from Calcutta to Kursiong. A serious accident occurred to the case containing the seedlings of *C. Pahudiana*; by the stumbling of one of the eight coolies carrying the case, it was upset, and all the plants were, more or less, uprooted. Although they were immediately replanted by Mr. Stubbs, and the case containing them was left for nine days near the spot where the accident happened under the care of an experienced native gardener, not one of them survived. On the 27th May the conservatory was completed, and the chinchona plants were at once moved into it from the room where they had been placed on their arrival at Sinchal. All had suffered greatly from the effects of their long journey, and the unavoidable delay in preparing proper accommodation for them. There is, however, a very marked difference in the loss between the plants from Java and those from Ootacamund. Out of 59 plants obtained from Java only one death occurred, while of the 170 plants from Ootacamund, no less than 30 were completely lost. This difference in the healthiness of the plants from the two places becomes more striking, when it is known that the plants from Java were brought by coolies from the mountains in the interior of that island to Batavia, and thence by steamer to Calcutta; while those from Ootacamund were transported in 12 hours by railway over most of the land journey, and the sea voyage only lasted three days. The plants from Java were, in addition, exposed for two months longer than the others, to the confinement of small pots and Wardian cases, as they arrived in Calcutta two months before them.

The following table shows the stock of chinchona plants on the 1st June, and the number of deaths in each species from the time of their leaving Calcutta:—

TABLE II, showing condition of Chinchona Plants from 24th March to 1st June.

NAME OF SPECIES.	Loss of Plants.	Loss of Seedlings.	Total of Losses.	Plants Remaining.	Seedlings Remaining.	Total of Plants and Seedlings.
<i>Cinchona succirubra</i> -	10	-	10	74	-	74
„ <i>Calisaya</i> * -	None	-	None	5	-	5
„ <i>nitida</i> -	15	-	15	41	-	41
„ <i>micrantha</i> -	9	-	9	33	-	33
„ <i>Peruviana</i> -	None	-	None	2	-	2
„ <i>Pahudiana</i> * -	1	548	549	53	None	53
„ <i>species ignota</i>	3	-	3	3	-	3
GRAND TOTAL - -	38	548	586	211	None.	211

The plants of the species marked*, were obtained from Java. The seedlings of *C. Pahudiana* were raised in the Calcutta Botanic Gardens.

During the month of June, the propagation of all the species, except *C. Pahudiana*, was successfully prosecuted, and the number of deaths was reduced to seven. The process of layering was the only method followed, and by it, young well-rooted plants were procured in from 21 to 30 days, in the case *C. succirubra*, *C. nitida*, and *C. micrantha*. The plants of *C. Pahudiana* could easily have been artificially propagated, but as they were all finely formed plants raised from seed, I was unwilling to do anything that might interfere with their attaining their full development, the more so, as I had a large quantity of apparently good seed which I had sown in the end of May. The only seedlings among the other species, were the few plants raised in the Botanic Gardens, Calcutta, and of these, none were layered.

During June, a few of the seeds of *C. Pahudiana* germinated. On the 1st July, the return of the stock of all the species was as follows:—

TABLE III, showing the Number of Plants of Chinchona on 1st July 1862.

NAME OF SPECIES.	Loss of Plants since 1st June.	Increase of Plants since 1st June.	Increase of Seedlings since 1st June.	Total Increase of Plants and Seedlings.	Total of Plants and Seedlings on 1st July
<i>Cinchona succirubra</i> - - -	3	36	-	36	107
„ <i>Calisaya</i> - - -	None	1	-	1	6
„ <i>nitida</i> - - -	2	9	-	9	48
„ <i>micrantha</i> - - -	2	7	-	7	38
„ <i>Peruviana</i> - - -	None	None	-	None	2
„ <i>Pahudiana</i> - - -	„	„	486	486	539
„ <i>species ignota</i> - -	„	„	-	None	3
GRAND TOTAL - - -	7	53	486	539	743

In the following month, July, the increase was much greater, both by layers and seed. All the plants made a considerable growth, and had acquired a much healthier appearance. On the 1st August, most of the seedlings of *C. Pahudiana* had their two pairs of leaves well developed, and a few had formed their third pair.

This last table is the return of the plants on the 1st August, drawn up in the same manner as table III. :—

TABLE IV., showing the Number of Chinchona Plants on 1st August.

NAME OF SPECIES.	Remaining on 1st July.	Loss of Plants since 1st July.	Increase of Plants since 1st July.	Increase of Seedlings since 1st July.	Total Increase of Plants and Seedlings since 1st July.	Total of Plants and Seedlings on 1st August.
<i>Cinchona succirubra</i> -	107	1	32	—	32	138
„ <i>Calisaya</i> -	6	None	2	—	2	8
„ <i>nitida</i> -	48	„	13	—	13	61
„ <i>micrantha</i> -	38	2	6	—	6	42
„ <i>Peruviana</i> -	2	None	2	—	2	4
„ <i>Pahudiana</i> -	539	„	None	814	814	1,353
„ <i>species ignota</i>	3	„	2	—	2	5
GRAND TOTAL - -	743	3	57	814	871	1,611

The rate of propagation will increase every month, as in periods varying from three to six weeks; the new plants are ready to be artificially propagated in their turn, while the many shoots made by the plants that have already yielded new plants, are likewise available for layers or cuttings.

On leaving Calcutta in March, I placed four plants of *C. Pahudiana*, and two of *C. succirubra* under the charge of Mr. Scott, head gardener, Botanic Gardens, with directions to treat them like any other tropical plant, but to keep them in a rather shaded part of the gardens. I was also obliged to leave 14 cuttings of *C. succirubra*, three of *C. nitida*, and one of *C. micrantha*, in the cutting beds of the Botanic Gardens. I received a report on the condition of all these plants on the 22d July. Up to that date, the losses had been two plants of *C. Pahudiana*, eight cuttings of *C. succirubra*, and the cutting of *C. micrantha*. The two plants of *C. succirubra* were in good health; one of them was then 18 inches in height, and the stem immediately above the ground, was one inch and six-tenths in thickness, while the leaves average six to ten inches in length, and from five to seven inches in breadth.

The climate of Calcutta does not seem to be too hot for this species, by far the most valuable of all the cinchonæ.

— No. 116. —

INFUSION of the Leaves of *Chinchona succirubra* used as a Febrifuge.

From *T. Anderson*, Esq., M.D., Officiating Superintendent, Botanic Gardens, Calcutta, to *H. Bell*, Esq., Under Secretary to the Government of Bengal (No. 13), dated 9 September 1862.

I HAVE the honour to report to you, for the information of the Lieutenant Governor, that I have succeeded in forming an infusion of the leaves of *Chinchona succirubra* from the plants of that species in the cinchona nursery, near Darjeeling. The leaves fell off spontaneously during the months of June and July.

I sent the infusion to Dr. Collins, civil surgeon of Darjeeling, with a request that he would administer the infusion to some of the patients in the civil hospital.

He has just informed me that he had given the infusion in doses of one fluid ounce to the first four cases of intermittent fever that occurred, and that these patients had been cured without any other medicine whatever.

This result proves that the infusion of the leaves of *Chinchona succirubra* possesses some of the febrifuge properties of cinchona; the infusion is of a dark chocolate colour, and is intensely bitter. I hope to be able to submit an account of the chemical analysis of this infusion by Dr. Macnamara, chemical examiner to Government.

— No. 117. —

Bengal Revenue Proceedings, December 1862, No. 161.

EXTRACT from a Report from *C. B. Stewart, Esq.*, on the Province of Cachar, to the Landholders and Commercial Association at Calcutta.

10 November 1862.

IN fulfilment of the promise made to the chairman of the association, I have now the pleasure to submit a report of my observations during my recent visit to Cachar and Sylhet.

* * * * *

Chinchona.—From what I have seen of the country, and from what I have read and heard regarding the culture of the cinchona, I feel assured that the plant would thrive well in the open air on the more elevated ranges of hills in Cachar and Assam; it would therefore be well if Government would either introduce it into those districts, or give small contributions of seeds and plants to a few well-known men who would willingly undertake the experiment.

— No. 118. —

From *J. Murray, Esq.*, to *Herman Merivale, Esq.*, c. b.

Sir,

Foreign Office, January 1862.

WITH reference to your letter of the 30th April of last year, I am directed by Earl Russell to transmit to you, for the information of the Secretary of State for India in Council, the accompanying copy of a Despatch from Her Majesty's Consul General at Batavia, enclosing a report and memorandum respecting the cinchona plantations in Java.

22 January 1862.

Herman Merivale, Esq., c. b.,
&c. &c. &c.

I am, &c.
(signed) *James Murray.*

Enclosure 1, in No. 118.

From *A. Fraser, Esq.*, to Earl Russell.

21, Clarendon-crescent, Edinburgh,
22 January 1862.

My Lord,

I HAVE the honour to wait upon your Lordship with information respecting the cultivation of the cinchona plant in Java, called for by the India Office by letter of 30th April 1861, copy of which was transmitted to me by your Lordship's Despatch of 8th May 1861.

The information embodied in the report enclosed is derived from the latest official returns kindly supplied to me by order of his Excellency the Netherlands Colonial Minister at the Hague, and the memorandum of instructions annexed to it is merely a translation made by me from the Dutch original. I have had both these documents printed for my own convenience, and forward with this letter several copies of each.

During

During my short stay in Calcutta in December 1860, I recommended to members of the Bengal Government interested in the subject, that a formal application should be made to the Governor General of Netherlands India for a supply of seeds and cuttings of the several kinds of the cinchona, being satisfied of the readiness of his Excellency to comply with a requisition of this kind; and I further suggested the mission of some scientific person from India to Java for the purpose of receiving the supply, and taking the required care of the seeds and cuttings in their carriage from Batavia to Calcutta.

I have been gratified to learn that both the recommendation and suggestion were acted upon, and that Dr. Anderson, superintendent of the Botanical Gardens, Calcutta, left Java about two months ago fully supplied with seeds and cuttings, and with every information regarding the cultivation of the cinchona in the power of the Java Government to give.

Had this information not been obtained by the Indian Government in the way described above, it was my intention to have accompanied the present report with translations of further documents of considerable length and detail, bearing on the cinchona plantations, which were also supplied to me from the Hague; and the leisure anticipated as necessary for this laborious work, taken in connexion with private engagements incident to my recent return to this country after an absence of many years, must be my apology for the delay which has occurred in submitting this report.

Trusting that the report as it stands, with the annex, may contain all the information desired by the India Office,

The Earl Russell.

I am, &c.
(signed) *Alexander Fraser.*

Enclosure 2, in No. 118.

REPORT of Mr. *Alexander Fraser*, Her Majesty's Consul at Batavia, respecting the present state and future prospects of the Cinchona Plantations in Java, and the Nature of the Organisation adopted by the Netherlands Government for the conduct of the experiment.

THE cultivation of the Cinchona plant in Java is still in a state of experiment, and still requiring scientific management, does not as yet belong to those branches of cultivation which are under the management of the Director of Cultures.

[These several branches of cultivation are fully treated of in a work entitled "Java, or how to manage a colony," by J. W. B. Money, published by Hurst & Blackett, London, 1861, vol. i. chapters 3, 4, and 5, to which reference is here made for the sake of brevity.]

THE conduct of the experiment has been entrusted to the care of Dr. D. F. Junghuhn, a scientific gentleman of considerable eminence, and it is the intention of the Government to leave it under his superintendence until the cultivation shall be considered as quite successful, *i. e.*, when the present trees are large and old enough to be barked, and the propagation no longer requires scientific supervision. The management will then be transferred to the Direction of Cultures.

Dr. Junghuhn is assisted in the management by Dr. J. E. de Vry, a chemist of some eminence, whose special duty it is to apply chemical tests from time to time to the barks of the cinchona to ascertain their intrinsic value.

To these officials is attached the following staff of overseers and labourers, whose duties, as well as those of Dr. Junghuhn, the superintendent, are laid down in a printed memorandum of instructions, translated from the Dutch, and forming the annex to this Report.

	Florins.	£.
1 European Overseer, 1st Class, on	125	monthly = 125 per annum
1 " " 2d "	100	" = 100 "
6 " " 3d "	75	" = 75 "
1 " " 3d "	50	" = 50 "
1 Native " (Mandore)	6	" = 6 "
15 " Labourers (Boedgangs)	5	" = 5 "

The salary of the superintendent, Dr. Junghuhn, is 1,250 florins monthly, or 1,250*l.* per annum; that of Dr. de Vry, the chemical assistant, 1,000 florins monthly, or 1,000*l.* per annum; besides which they are entitled to a free house, or allowance for house rent, which may be taken at about 100*l.* each per annum. Thus the whole present permanent annual outlay may be stated as follows:—

	£.
Salary of superintendent	1,250
Salary of chemical assistant	1,000
Allowances for house rent	200
European overseers	725
Native overseers and labourers	81
	£. 3,256

On the 31st December 1860, the state of the cinchona plantations in Java was as follows :

Calisaya :

Seeds in germination	-	-	-	-	-	-	-	264
Young plants in the beddings and germinating sheds	-	-	-	-	-	-	-	5,510
Plants and trees planted out	-	-	-	-	-	-	-	1,806

Lucumæfolia :

Seeds in stock	-	-	-	-	-	-	-	700,000
Seeds in germination	-	-	-	-	-	-	-	533,396
Young plants in the beddings	-	-	-	-	-	-	-	349,700
Plants and trees planted out	-	-	-	-	-	-	-	56,686

Succirubra (Red Cinchona) :

Young plants in the nursery shed	-	-	-	-	-	-	-	13
Young plants planted out	-	-	-	-	-	-	-	14

Lancifolia (Yellow Cinchona) :

Young plants in the nursery shed	-	-	-	-	-	-	-	38
Young plants planted out	-	-	-	-	-	-	-	42

Besides the above, there was then a supply in the nurseries of—

1,030 live cuttings of	<i>Calisaya</i> .
8 " "	<i>Succirubra</i> .
28 " "	<i>Lancifolia</i> .
10 " "	<i>Lanceolata</i> .

The extreme height attained by the trees at the same period (31st December 1860), was—

<i>Calisaya</i> ,	15 feet 8 inches English measurement.
<i>Lucumæfolia</i> ,	25 " 6 " " "
<i>Succirubra</i> ,	8 " 8 " " "
<i>Lancifolia</i> ,	15 " 2 " " "
<i>Lanceolata</i> ,	13 " 0 " " "

The ultimate success of the cinchona experiment in Java would seem mainly to depend upon the question (which time only will solve) whether a sufficient supply of seed shall continue to be obtained from the *Calisaya* and *Succirubra*. The other sorts contain less quinine, and it is specially maintained that the *Lucumæfolia* is a species producing very little quinine.

Edinburgh, 21 January 1862.

Alex. Fraser,
H. M. Consul.

ANNEX to REPORT on Cinchona Plantations in Java.

(Translation.)

MEMORANDUM of Instructions for the Official or Superintendent charged with the experiment of the cultivation of the Cinchona; for the Overseers employed in that culture, and the Rules of Administration to be observed therein.

Art. 1. The cultivation of the cinchona in Java is as yet considered as an experimental culture. The Governor General is to appoint the period at which the same shall come to be regarded as an ordinary Government culture (whether locally or generally), and when it shall therefore pass over to the ordinary management and direction of the chiefs of the provincial Government, under the Director of Cultures. So long as no declaration to this effect has been made this culture is to continue under the management and direction of a separate scientific functionary, appointed by the Governor General, whose income, official title, &c., are to be regulated on his appointment.

Art. 2. The success of the experiment of the cinchona cultivation, and, on its attainment, the preparation of the measures for its becoming one of the ordinary branches of the Government cultures, form the special duties of the superintendent. He is further, along with this, to make scientific and practical observations in respect of everything directly or indirectly connected with the cinchona culture.

Art. 3.

Art. 3. The superintendent of the cinchona culture will address to the Governor General all such proposals and reports as may appear to him to be advisable.

He will address to the Governor General:

a. At the end of every month, a report of the state of the experiment, of his own proceedings, and of the progress of the plantations, accompanied by a statement, showing the number and height of the cinchona trees in each plantation, and of the cuttings and young plants in the nurseries.

b. At the end of every year, a general report of the state of the experiment, and of the scientific and practical observations referred to in Art. 2.

The Report, and other returns before-mentioned, are to be addressed, under cover, to the Director of Cultures, who will send them forward to the Governor General, accompanied by his opinion upon them.

Art. 4. The superintendent will have the free use, without payment, of the Government post-horses, from the place of his own residence to the places where the cinchona experiment has been introduced, and the free use, at the expense of the Government, of the so-called district horses, and of other means of transport, where no posting establishment exists, and will visit these places as often as he shall consider advisable.

If he considers it necessary for the interests of the cinchona experiment to proceed elsewhere, he must apply for authority from the Governor-General, detailing his plans, and making known the nature of the assistance or co-operation on the part of the European and native Government servants which he expects to require.

The authority granted for this purpose by the Governor General will be considered, though not expressly mentioned, to extend to making use of steamers, or other opportunities by ship, of district horses, and other means of transport, at the public expense, and of the free use, without payment, of the Government post-horses.

Art. 5. The cinchona is not to be introduced into new districts without special authority to this effect from the Government. The decision pronounced on such proposal shall also regulate the outlay required for the first establishment, permanent staff, and necessary repairs.

Art. 6. The experimental cinchona culture, at the place where it is introduced, will be under the supervision of European overseers, who will be appointed to that office on the recommendation of the superintendent, and their income and further emoluments are to be regulated in the resolution by which they are appointed.

Art. 7. The European overseers are directly subordinate in the discharge of their duties to the superintendent, who has to furnish them with the necessary orders. They are responsible for the proper execution of these, and of all regulations published by the Government which have reference to the cinchona cultivation. Under their orders are placed the native overseers and labourers who are employed in the cinchona culture.

Art. 8. The experimental cinchona culture is to be carried on, if anyway possible, entirely by means of free labour.

To maintain and keep in repair the present establishments, nurseries and plantations, native overseers (mandores), and native labourers (boedgangs), are to be permanently employed on monthly allowances by the European overseers who shall, however, follow the orders of the superintendent regarding them.

For other extraordinary duties incident to the laying out of new plantations, such as the opening out of new ground, the clearing of the forest soil, the making of new fences, &c., extraordinary native overseers (mandores), and labourers (boedgangs) are to be employed.

The necessary materials should as much as possible, be procured by voluntary delivery or purchase from the population in the neighbourhood.

The monthly wages of the mandores and boedgangs, and the daily wages of the extraordinary mandores and coolies, are to be regulated according to the remuneration usually paid for free labour, regarding which the head local authority shall give a declaration to the superintendent, who, on his part, shall send in to the Government this declaration, along with his demand for authority for the outlay to be made, or approval of the outlay already made.

Art. 9. In case it should appear impossible to the European overseer to obtain free labourers, he shall give timely notice of this circumstance to the chief local authority, and apply for his interference to obtain them.

Should the chief local authority be also unable to obtain free labourers, he shall then proceed to call out the legal servitude of the native population. These forced labourers shall receive the same wages as are allowed to free labourers.

The chief local authority shall, in like manner, proceed to obtain the necessary materials from the population, paying them the prices already fixed for the same.

Art. 10. With a view to provide for such necessities as cannot readily be obtained by the chief local authorities within their jurisdiction, and must therefore be imported from elsewhere, the superintendent shall make a demand in writing to the chief local authority once a year, about the month of September, of what he may expect to require during the following year, and, in that case, those necessities shall be served out to the overseer at once, and he will then be responsible to the superintendent for the use of them. For articles to be ordered from Europe, the demand must be made at least a year beforehand.

Art. 11. The overseers must refrain from arbitrary proceedings in the discharge of their duties in those cases which are provided for by the superintendent in general regulations or special orders.

They must strictly refrain from planting out young plants from the nurseries to the plantations in the forest, or from making changes in the existing plantations, without having received an express order to this effect from the superintendent.

Art. 12. The overseers have to take care that no forest trees are cut down or burnt in the vicinity of the cinchona plantations, and especially in parts or places indicated by the superintendent, and must immediately give notice thereof to the head of the local government and to the superintendent.

Art. 13. The overseers must try, by a considerate treatment of the natives with whom they come in contact, to incline them to provide voluntary labour and materials for behoof of the cinchona culture experiment.

Art. 14. The overseers, permanent mandores, and permanent boedgangs, must reside, as much as possible, in proximity to each other, at some place in the vicinity of the cinchona plantations which shall be pointed out by the superintendent. They must not absent themselves therefrom unnecessarily, to the prejudice of the interests entrusted to their care, and in no case at variance with orders received.

Art. 15. The overseers receive their salaries, and those of the permanent mandores and permanent boedgangs, once a month, at the end of the month, from the public treasury nearest to the place where they reside, on the presentation of a salary table made up by the overseer in duplicate.

If any part of the salary remain unpaid, in consequence of the discharge, or otherwise, of one of the native staff, this amount shall be deducted from the salary table of the following month, and so much less received.

Art. 16. The superintendent makes written demands, in duplicate, for extraordinary disbursements in the purchase of materials, which he sends to the overseer, and the local government can make advances successively on these demands, according to the requirements to be stated by the overseer, taking care, at the same time, not to exceed the amounts allotted by the Governor General for this purpose for each working year.

The superintendent takes care that this advance is adjusted once a year, in the account of disbursements made to labourers and for materials, which must be made up in duplicate by the overseer; and, after having been signed for, seen and approved, by the superintendent, shall be receivable at the public treasury.

Art. 17. The chief of the local governments will appoint a native official, who shall always be present at any labour performed by ordinary forced labourers, supplied by the government of that locality, and shall receive, at the charge of the account for extraordinary labour, the double day's wages of an extraordinary mandore. To this native official is entrusted the direction of the duties of the extraordinary labourers, according to the orders and directions of the overseer.

He requires to be always present at the daily payment of the extraordinary labourers, and of the materials delivered by order of the government, and to keep a note of them, which he shall send in at the end of each month, through the Regent, to the head of the local government.

The local government shall from time to time assure themselves of the proper financial administration of the overseers, by having their cash inspected, and balance in hand told, by a comptroller or other official, in connexion with the advances given in the above-mentioned monthly statements of payments made.

Art. 18. The overseers of the cinchona culture have to keep the following registers, according to forms to be fixed by the superintendent:—

1. A name payment-roll of the permanent mandores and boedgangs, in which must appear their names, the district or village in which they last resided, and where they come from, if they are married or single, the date of their entering into service, the date of their leaving service, the monthly wages paid, and the sum total; also the price of the victuals supplied.

2. A cash-book, in which all receipts and disbursements are stated.

3. An inventory-book, in which the implements in stock, received or written off, tools, utensils, or other materials; also nursery tubs, stores, cases, panes of glass, &c., are noted down.

4. A register of the cinchona plantations, in which the number and height of the cinchona trees in the plantations, and the number of the plants in the nurseries, are noted, the height of the plants being all measured on the 20th of each month, a measure for which will be supplied by the superintendent.

Art. 19. The overseer of the cinchona culture addresses to the superintendent, at the end of each month, according to the forms to be fixed by him:—

- a. An extract from the cash-book.

- b. A statement of the cinchona trees, and of the plants in the nurseries.

- c. A report, regarding the state of the plantations and nurseries, of the principal duties performed, and other occurrences; and,

- d. Every three months, an extract from the inventory-book.

—No. 119.—

CEYLON.—ROYAL BOTANIC GARDEN.

REPORT for 1861, by Mr. *Thwaites* (Director).

HORTICULTURAL DEPARTMENT.

CHINCHONA.—It gives me great pleasure to be able to report very satisfactorily upon the progress of the important experiment now being made in the island, in the cultivation of species of the valuable quinine-producing chinchonas. An experienced gardener has, as requested by the Government at my suggestion, been sent out by Sir William Hooker, from the establishment at Kew, and I have much reason to be satisfied with the zeal and intelligence shown by Mr. M'Nicoll in his charge of the plants now under his care at the Hakgalle Garden near Newera Ellia.

The plants of chinchona which, in my last report, I mentioned as being expected from Bombay, arrived at the latter place in so unpromising a condition that it was thought best to have them all dispatched at once to the Neilgherries, instead of sending a portion, as was at first intended, for trial on our hills. Nearly all of these plants subsequently died. Another consignment of chinchona plants, collected by Mr. Spruce in South America, arrived some months afterwards at Bombay, in very good condition; but these were also all conveyed to Ootacamund, not any being reserved for Ceylon, as I was given to understand would be the case. As far, therefore, as regards Mr. Markham's mission to South America, we have received here no growing plants of chinchonas; but a parcel containing seeds of *Chinchona micrantha* and *Chinchona nitida*, collected by Mr. Pritchett, was sent to me in February last, from Mr. M'Ivor, through the Chief Secretary to Government, Fort St. George; and a parcel was received by me shortly afterwards from the Secretary of State's Office, which contained seeds of *Chinchona succirubra*, collected by Mr. Spruce. From these seeds more than 800 plants have been raised. (*C. succirubra*, 530; *C. micrantha*, 180; *C. Peruviana*, 25; *C. nitida*, 45; uncertain, 60;) which, although at present necessarily of small size, are nevertheless progressing very satisfactorily in the locality which has been selected for them.

From Mr. William Ferguson have been received a few chinchona seeds, which he obtained from a friend at Lima; but these have unfortunately not germinated, and they were probably not in a sufficiently fresh state for doing so.

To Sir William Hooker we have been indebted for the transmission to us, at different times, from the collection at Kew, of six plants of the very valuable *Chinchona Calisaya*: the greater number of these, however, suffered so much in their transit, that two only of those kindly taken charge of for me by Dr. Anderson of the Calcutta Botanic Gardens, arrived here in a healthy state. They are now planted out in the Hakgalle Garden, and are growing vigorously. Mr. M'Nicoll has, without risk of delaying the period of flowering, succeeded in obtaining from one of them eight cuttings, two of which have produced roots, and he has every reason to anticipate success with the remainder.

During the present month, I have received from Dr. J. Anderson, a portion of a supply of chinchona seeds, communicated by the Government of Java to that of India, but from what species they were collected has not been stated. These have been sown at the Hakgalle Garden, and a very few of them here; they have, however, not yet been in the ground sufficiently long a time to germinate.

From the experience we have had of the species of chinchona now growing in the island, I think it may be considered certain that *C. Calisaya* would not be likely to succeed at an elevation much below that of Hakgalle, and that it should be planted above 5,000 feet. *C. succirubra* grows extremely well at Hakgalle; but as it also grows tolerably well at Peradenia, with the appearance only of being a little too much forced by the heat, I think it might succeed probably at any elevation above 3,500 or 4,000 feet. *C. micrantha*, judging from one little plant we have retained at Peradenia, appears to thrive quite as well here, as at Hakgalle: it will, however, have to be ascertained bye-and-bye at what elevations

respectively this and the other species will produce the largest relative quantity of quinine.

As I have reason to believe that many gentlemen engaged in coffee-planting would be glad to co-operate in trying experiments in the cultivation of the chinchonas at different elevations upon their estates, it may possibly be considered desirable to distribute, some short time hence, under conditions to be determined upon, a few plants of those raised at Hakgalle. This course of action might probably lead to a more extensive cultivation of chinchona in the island, than the Government would feel disposed itself to undertake, though it would be no doubt desirable for the present experiment to be carried on with every possible activity and carefulness, until the cultivation should be well understood, and it could be fairly given over to private speculation.

— No. 120. —

ROYAL BOTANIC GARDEN.

REPORT for 1862, by Mr. *Thwaites* (Director).

HORTICULTURAL DEPARTMENT.

CHINCHONA.—The experiment in the cultivation of some of the quinine-producing cinchonas is proceeding most favourably, and the progress made may be considered extremely satisfactory, taking into consideration the limited supply of seeds we received to commence with. Mr. M'Nicoll has been very successful in the management of the plants under his care at Hakgalle. Several of the larger ones have been planted in the forest, and are flourishing vigorously, and preparations are now being made for many more being put out. Open spaces of a moderate area are being cleared in the forest, in order that the plants may have plenty of light, and yet be sufficiently protected by the surrounding trees from too much wind, which the chinchona plants are not able to bear without injury, owing to the large size and not very firm texture of their leaves. Much care is required in these arrangements; for the chinchona plants become drawn up and weak when in dense shade; whilst, if exposed to plenty of light, with direct sun light upon them for a few hours during the day, they assume a most healthy and robust appearance, with stems of a deep red colour, and leaves of a much firmer texture. A certain number of the plants, placed in very favourable situations for shelter from the wind, are being allowed to grow up to their full height, with the view of their producing flowers and seed; but as it will probably be only after the expiration of some few years that this will occur, and as it is desirable, in order to be prepared for an early distribution, to increase the number of our plants as rapidly as possible, Mr. M'Nicoll is effecting the latter object by striking cuttings from a considerable number of plants which he has reserved for the purpose. Large cuttings of *C. succirubra* would appear to strike readily in the open ground; but of large cuttings we can of course get only a few at present, owing to our plants being all young. Smaller cuttings are struck in a hotbed, and roots are produced upon them in a fortnight or three weeks. After as many cuttings have been taken from the reserved plants as these will at one time yield, some interval must necessarily elapse before other shoots are produced of suitable size for removal for the next lot of cuttings. Mr. M'Nicoll will have, before many days, nearly 600 plants of *C. succirubra* struck from cuttings, and he anticipates that this number will be very considerably added to in a few weeks. Many of these plants will probably be sufficiently established in growth to bear removal in three or four months, should it be deemed desirable by Government to commence their distribution so soon—on a small scale, of course, at first. It may be thought advisable to allow applicants to have, at a price to be determined upon, a few, say, four or five plants, to enable them to ascertain the suitability or otherwise of localities they may have selected for the cultivation of this valuable plant. Some plants of *C. succirubra* received from the establishment at Kew during the past year, and which arrived in not very strong condition, I have deemed it desirable

sirable to keep at Peradenia, for propagation from by cuttings. Of 150 which were despatched from Kew 110 survived, and are now growing well here. From these, and from a few plants we raised from seed, Mr. Cameron has, by means of a hot-bed he has constructed here, succeeded in striking a good many cuttings which will be useful by-and-by for distribution in districts contiguous to this.

Although the climate of Peradenia is not so favourable for *C. succirubra* as is that of Hakgalle, some plants of it growing in the open ground here are, nevertheless, doing very well; and we find that, even at this low elevation, they thrive best when well exposed to the light, with the sun upon them for an hour or two during the day. Exposure to the sun for the whole of the day is more than they can bear without injury.

Of *Chinchona Condaminea*, a small supply of most excellent seeds was received a few months ago from Mr. Clements R. Markham. From these a number of young plants have been raised by Mr. M'Nicol, and are in a thriving condition at Hakgalle. The climate of Peradenia is much too hot for this valuable species.

C. Calisaya has not succeeded so well with us as have the other kinds we have under cultivation, owing, I believe, to the plants, which were all received from Kew, having been injuriously affected by the long voyage from England. I am expecting a number of plants of this desirable kind from Java; Mr. Van Spall, of the Civil Service of that island, who visited Ceylon a short time ago, having kindly interested himself in the matter, and obtained the sanction of the Javan Government for the transmission of some plants of *C. Calisaya* to this establishment.

The following is a list of the chinchona plants under cultivation at Hakgalle:—

<i>C. succirubra</i> , planted out in the forest	-	-	-	-	-	-	-	-	194
The largest plant being just four feet high, with a stem $1\frac{1}{2}$ inches in diameter, and leaves 18 inches long by 12 inches wide.									
Ditto - in pots, to be planted out as soon as spaces have been cleared in the forest for their reception	-	-	-	-	-	-	-	-	338
Ditto - in pots, struck from cuttings	-	-	-	-	-	-	-	-	395
Ditto - cuttings not yet quite rooted	-	-	-	-	-	-	-	-	200
<i>C. Condaminea</i> , in pots	-	-	-	-	-	-	-	-	960
<i>C. crispella</i> , in pots	-	-	-	-	-	-	-	-	24
<i>C. Calisaya</i> , in pots	-	-	-	-	-	-	-	-	2
<i>C. Pahudiana</i> , in pots	-	-	-	-	-	-	-	-	4

The following plants, raised from seeds sent to me under the several names appended to them, are at present quite undistinguishable by their foliage:—

<i>C. micrantha</i> , planted out in the forest	-	-	-	-	-	-	-	-	43
Ditto - in pots	-	-	-	-	-	-	-	-	130
<i>C. micrantha</i> } planted out in the forest	-	-	-	-	-	-	-	-	18
<i>provinciana</i> . }									
Ditto - in pots	-	-	-	-	-	-	-	-	6
<i>C. nitida</i> , planted out in the forest	-	-	-	-	-	-	-	-	15
Ditto - in pots	-	-	-	-	-	-	-	-	40
<i>Cinchona</i> sp. planted out in the forest	-	-	-	-	-	-	-	-	34
Ditto - in pots	-	-	-	-	-	-	-	-	31

The following is a list of the cinchona plants at Peradenia:—

<i>C. succirubra</i> , planted out in the grounds	-	-	-	-	-	-	-	-	36
Ditto - in pots (including the plants received from Kew)	-	-	-	-	-	-	-	-	114
Ditto - in pots, struck from cuttings	-	-	-	-	-	-	-	-	143
Ditto - cuttings not yet quite rooted	-	-	-	-	-	-	-	-	118
<i>C. micrantha</i> , which, when in a young state appeared to thrive well at Peradenia, put on subsequently an unhealthy weak appearance, and the few plants we had here have been sent to Hakgalle.									

— No. 121. —

Sir,

Foreign Office, 27 March 1862.

With reference to your letter of the 12th instant, I am directed by Earl Russell to transmit to you a copy of a letter which has been addressed to Her Majesty's Ambassador at Paris by Monsieur Thouvenel, stating that the Governor General of Algeria would be glad to be furnished with some chinchona plants,

with the view of endeavouring to acclimatise them in that colony, and I am to request that, in laying this letter before Secretary Sir Charles Wood, you will move him to cause Lord Russell to be informed whether this request can be complied with.

Herman Merivale, Esq.
&c. &c. &c.

I am, &c.
(signed) *E. Hammond.*

Enclosure 1, in No. 121.

M. l'Ambassadeur,

Paris, le 22 Mars, 1862.

J'AI eu l'honneur d'écrire à V. E. le 6 Février dernier et le 10 de ce mois pour l'informer que le Muséum d'Histoire Naturelle et la Société Impériale d'Acclimatation acceptaient avec empressement quelques uns des pieds de cinchona que l'India Office a bien voulu offrir de mettre à la disposition du Gouvernement de l'Empereur.

Le Gouverneur Général de l'Algérie, à qui j'avais également fait connaître cette obligeante proposition, vient de m'informer que la culture du cinchona pourant être tentées avec quelques chances de succès sur plusieurs points de la Colonie, il recevrait avec reconnaissance un certain nombre d'exemplaires de ce végétal.

Je me plais à espérer, M. l'Ambassadeur, qu'il sera possible à l'India Office de satisfaire encore à cette nouvelle demande.

S. E. le Comte Cowley.

Agréé, &c.
(signé) *Thouvenel.*

Enclosure 2, in No. 121.

From *Herman Merivale, Esq., c.B.*, to the Under Secretary of State for Foreign Affairs.

Sir,

India Office, 29 March 1862.

I AM directed by the Secretary of State for India in Council to acquaint you that, in compliance with the request from M. Thouvenel, forwarded with your letter of the 27th instant, Sir William Hooker has been instructed to reserve 200 or 300 plants of the cinchona for transmission to Algeria, at a proper season. I am also to inform you that as the arrangements with the authorities at the Royal Botanical Gardens at Kew terminate this day, Sir William Hooker has been referred to your department with regard to any expense incurred on account of these plants after the 31st instant.

I have, &c.
(signed) *Herman Merivale.*

Enclosure 3, in No. 121.

From *Herman Merivale, Esq., c.B.*, to Sir William Hooker.

Sir,

India Office, 28 March 1862.

THE Secretary of State for India in Council having received an application through Earl Russell from the French Government, for a supply of cinchona plants for transmission to Algeria, I am to request that you will reserve 200 or 300 plants for transmission to that destination. You will be informed in a few days with whom you should communicate on this subject, and I am to refer you to the Foreign Office for the liquidation of any expenses which may arise under this head.

I am also directed to inform you that it has been resolved by the Secretary of State in Council, in consequence of the success which has attended the cultivation of the cinchona plant in the Government gardens at Ootacamund, to discontinue the auxiliary establishment under your charge in the Royal Gardens at Kew, and that the time has arrived when your account with this office may be closed. It will therefore rest with you to determine respecting the disposal of the plants under your charge, after having allotted those required for the French Government.

I am to take this opportunity of expressing the thanks of the Secretary of State for India in Council for the ready and able assistance which has been afforded by yourself and your subordinates on every occasion when it was required to promote the success of this important experiment, which has now been initiated in several quarters of Her Majesty's dominions.

I have, &c.
(signed) *Herman Merivale.*

EAST INDIA (COAL FIELDS).

RETURN to an Address of the Honourable The House of Commons,
dated 23 June 1862 ;—for,

A "COPY of Dr. *McClelland's* REPORT on the COAL FIELDS of *India*."

India Office, }
17 June 1863. }

W. T. THORNTON, Secretary,
Public Works Department.

(*Mr. Alcock.*)

Ordered, by The House of Commons, to be Printed,
19 June 1863.

COPY of Dr. *M^cClelland's* REPORT on the COAL FIELDS of *India*.

INTRODUCTION to the REPORTS of the COMMITTEE for 1841.

It rarely happens that a single Coal basin presents a complete series of all the beds constituting the Coal Formation, much less the transition between that formation and either of those which naturally follow or precede it in the regular order of stratification.

Hence much of the difficulties in conducting geological inquiry : for instead of finding strata collected together in natural groups, we find them dispersed, so as to render the examination of large tracts of country necessary before the structure of any part of it can be well understood.

Although Coal has been formed in basins, we are not to expect it in valleys alone. Physical geography has undergone so many changes since the remote period when the formation of Coal took place, that its beds are now found in every variety of position, dislocated and broken by eruptions of trap-rocks and other causes of general disturbance.

The assemblage of rocks called the Coal formation are sandstone, slate-clay or shale, coal, and often, but not always, mountain limestone, which is also called carboniferous limestone. When we consider the manner in which these beds are transposed, an abstract description of them can be of little value; nevertheless, as we have little or no details regarding the structure and peculiarities of the Coal formations of India, we can do no more in a sketch of this kind than afford an outline derived from general information.

SANDSTONE OF THE COAL FORMATION.

This is a thin-bedded, distinctly stratified rock, very various in its texture, being composed either of large grains of quartz loosely aggregated; and at other times the rock is so persistent as to answer for millstones. The sandstones of the Scotch Coal formations near Glasgow and Edinburgh are used for building purposes, while those of Newcastle are too soft and friable to answer as a building stone. The grains of these sandstones are almost exclusively quartz, intermixed with plates of mica. Sometimes nodules of slate-clay and carbonate of iron occur in it, and in Scotland it contains occasionally fossil wood converted into Coal. It usually alternates with thin seams of coal and shale. At Cherra Ponji, the first stratum of grit which occurs above the Coal is about four feet in thickness and is perfectly friable, composed of large grains of quartz with very little mica. It is separated from that part of the Coal which was exposed in 1835 by a thin bed of shale. The beds of sandstones that occur below the Coal at Cherra are more numerous and important, and are composed of finer particles; but still they are loosely aggregated so as to constitute a soft somewhat friable rock, disposed in strata of various thickness from an inch to three or four feet, the seams or interstices between the strata being formed of thin plates of carbonaceous matter. Although this rock probably occurs in all the Indian Coal fields, the only specimens of it which we can venture to describe as characteristic are those received from Mr. James Pontet, in a Coal district situated on the Burmany river, near the village of Doobradgepore, about 60 miles west of Moorshedabad. In these specimens the sandstone alternates with layers of shale; these rocks pass into each other, and are often combined in the same specimens; and the whole alternate with layers of Coal. In Palamow, we are told that the six-feet Coal found on the banks of the Amanath is overlaid by a sandstone 40 feet in thickness; but we have no description of this rock so as to be enabled to know

whether it be really the sandstone of the Coal measures, or whether it may not belong to the new red, or overlying group; the character of the Coal would suggest the latter as most probable, and consequently that the most valuable Coal beds are below the six-feet bed, the only one exposed.

SLATE CLAY OR SHALE.

This is also a member of the Coal series, which assumes a great variety of form. It is usually a dull, black, soft rock, containing scales of mica, which give it a slaty structure. On the one hand slate-clay passes into Coal, and on the other, into sandstone. It also assumes a great variety of appearances in different Coal fields, according to which it receives peculiar local or provincial names from the miners. Its slaty fracture is not unfrequently produced from the abundance of fossil plants which it contains. Specimens of this rock, which we have seen from Burdwan and the Burmany Coal district already referred to, on the southern side of the Rajmehal hills, were peculiarly rich in fossil plants. The species in both instances were the same. The shale passes occasionally into clay ironstone; at least some specimens of shale, which we have received from Indian Coal districts, show a tendency both in weight and consistence to clay ironstone, which is an abundant rock in the Coal districts of Arracan, Burmany, Assam, and Palamow. All the Indian specimens we have seen of this ore are, however, of low specific gravity, not exceeding 3·3. We have never seen any specimen of clay ironstone from Burdwan, although we should suppose it exists there; but we know red and yellow ironstones to be very abundant in the Burdwan Coal district. In the Cherra Coal measures clay ironstone does not occur, and the iron of that district is manufactured from magnetic iron ore derived from washing the sands of decomposed gneiss rocks in the neighbourhood of Cherra.

COAL.

The beds of Coal in ordinary Coal formations are very numerous. In North-umberland there are 30 beds of Coal, 62 beds of sandstone, 20 beds of mountain limestone, and 128 beds of slate-clay. The lowest bed of sandstone is 228 feet in thickness, and the depth penetrated is 4,035.*

In the Edinburgh Coal field there are 337 beds, consisting of sandstone, limestone, coal, slate-clay, and shale. There are 80 beds of Coal, but most of them too thin for working; the beds of limestone amount to eight.†

The Bristol Coal field is 4,440 feet thick, and contains 36 beds of coal, mostly very thin, but the beds not exceeding three feet in thickness, are in that district worked with profit:‡ and at Radstock, near Bath, where the average thickness of seven beds is but 1 foot 7 inches, the mines are worked with great advantage.§

As none of the Indian Coal fields have yet been cut through, and none of them, with the exception of Burdwan, as yet properly opened, we have no information whatever before us as to the depth and extent of the beds of which they are composed. With the exception of the Cherra Ponji, all the Coal yet raised from Indian mines is crop, or superficial bed. The want of facilities for mining, the remoteness of the Coal districts, the difficulties of travelling, and, above all, the want of intelligence in all things connected with such operations, must long retard all those important interests which are connected with and dependant on the opening of mines in new districts.

LIMESTONE.

This rock is generally regarded as a member of the Coal series, and we believe is usually found to alternate with the other beds. When connected with the presence of Coal, this limestone is of a dark bituminous colour, containing blotches.

* Thomson's Outlines of Mineralogy and Geology, I. 149.

† Ibid. l. c.

‡ Ibid. l. c.

§ Letter of Richard Boodle, Esq., 12th September 1840.

blotches of carbonaceous matter. Its fracture is generally conchoidal, and its structure compact. When accompanied with Coal, it is necessarily stratified, and alternates with shale, coal, and sandstone. At Cherra Ponji this limestone is situated beneath the coal, in a thick bed of about 20 feet deep; and from it we extracted, in 1835, 27 species of shells, such as those which are found to characterise the Coal measures in Britain, but none of the species have yet been identified. The whole are figured in the first Reports of the Committee,* plate 2. The specimens themselves have been deposited in the Geological Society's Museum, in London, where they may be compared with the fossils of the English Coal-beds.

A limestone containing similar fossils has been found in Assam, but whether in connection with the Coal formations of that province has not yet been ascertained.

We have no information as to the existence of limestone in the Coal-beds of Burdwan, Palamow, or Tenasserim; but as no description of these deposits has yet been communicated, we cannot say how far the series of beds composing them may be peculiar, or different from those of other coal formations. Although this limestone always enters into the series of Coal strata, yet it frequently extends to districts in which no coal exists, where it receives the name of mountain limestone.

The limestone in some cases is most developed at the lower portion of the Coal measures, where it rests on old red sandstone. Sometimes this position is occupied by millstone grit, and occasionally these rocks, one or both, are much more developed than the shale and coal, and form detached hilly tracts, unassociated with Coal. Thus the limestone, where it is in contact with Coal at Cherra Ponji, is altogether only about 10 or 20 feet in thickness; but a few miles to the west of the Coal, in the direction of Mosmye, it swells out into small rugged hills of from 200 to 400 feet in height, containing caverns. In like manner the limestone of the English Coal formation occurs extensively towards the north of the Penine chain, forming of itself a middle region of hills, under the name of mountain limestone, after it has quitted the great central Coal fields of England.

The limestone of the Coal measures accompanied with millstone grit is accurately described, but apparently mistaken for other rocks, by Captain Dangerfield,† Mr. Hardy,‡ and Major Franklin,§ in various parts of Malwa, Bundelcund, and Nerbudda, where Coal itself has recently been discovered in various situations, none of which have as yet been described.

TRAP DYKES.

These are masses of rocks supposed to be of igneous origin, projected from below upwards, dividing the generality of Coal fields in various directions, and occasioning what miners call troubles. These dykes are not peculiar to the Coal measures, although they are more remarkably developed in this than in any other formation. These dykes not only intersect the various beds of Coal, but displace the horizontal levels, so that on one side the beds are raised, and in the other they are lowered. This displacement may only be slight, or it may be to such a degree as to render it difficult again to discover the continuation of the bed. Beds of greenstone and basalt have been mentioned as occasionally occurring in Coal measures; but this very rarely happens, and when it does such beds are of partial extent, and may be referred to trap-dykes. Although dykes are attended with some inconveniences to miners, yet they have their advantages in rendering many beds of Coal accessible which would otherwise remain unknown. Dykes are also serviceable in cutting off the water, and thus rendering mines comparatively dry.

FOSSILS OF THE COAL MEASURES.

These are so numerous that a mere list of them would swell our sketch to an unreasonable extent. Those which are most common in the millstone grit are stems,

* Calcutta, 1838.

† Malcolm's Central India.

‡ Res. Asiatic Society.

§ Ibid.

stems, the outer surface of which is removed and converted into Coal, or carbonaceous dusty matter. It is in the shale, however, in which the most abundant remains of plants are found, while the shells chiefly occur in the limestone. The following examples of fossils may be said to be characteristic of the Coal formation:—Ferns of various kinds, in which there is merely the impressions of the leaves; these form above half the entire fossil flora of this period. As no fructification is observed, they are divided into groups merely, according to the form of the leaves, &c. *Lepidodendrons*, or plants having a thick compressed stem, with depressions of various forms on the surface. Some of these forms are supposed to have borne some relation to the present coniferous plants. The other tribes of Coal plants belonged to orders which are altogether extinct, as *calamites*, *stigmaria*, *sigillaria*, &c. Of the shells it is only necessary to mention those resembling the muscle, which are often known to indicate the Coal measures, and are so abundant as to form what is called the muscle band in some of the English Coal fields.

It is not so much the number of species, as the number of individuals of some one kind of fossil, that affords the most valuable character of rocks. A due sense of the interest and importance of organic remains cannot therefore be readily conceived from books; for it is impossible in the description of a single species to impress the mind with the same idea of its importance as that which we derive from the inspection of countless numbers of the same object, multiplied so as to constitute a large proportion of the entire mass in which they are found.

We have hitherto considered the Coal formations as deposits in valleys or isolated basins, but from a general review of the different situations in which the mineral has been found in India, it will be seen that, whatever may have been the original level of these tracts at the time of the formation of Coal, nothing can be more diversified than their present aspect in this respect. The great number of dykes with which they are intersected, however, shows that they have, since the period of their original formation, been violently broken up by eruptions from below, as well as denuded by other causes of violence from without.

STRUCTURE OF BURDWAN COAL FIELD.

The Burdwan Coal district is, according to the description of Mr. Jones, situated in an undulating country composed of a slightly calcareous soil, resting on a sandstone seven feet thick, which caps the higher elevations. On the west, beyond Bankora, the district is bounded by hills of syenite. Towards the alluvial plains, the Coal rocks are, however, traced along the skirts of the hills to Beerbhoom and Rajmehal, and in a southerly direction to the Cuttack district. At Burdwan, Mr. Jones considers the breadth of the field about 11 or 12 miles. In a shaft 88 feet deep, Mr. Jones found 37 beds, of which eight were Coal, five sandstone, three soft clay, the remainder hard indurated shale and bituminous sandstone. The largest bed of Coal is nine feet in thickness, and about 40 feet from the surface.

In a northerly direction this Coal crosses the Singbhoom district, and extends along the south-eastern flanks of the Rajmehal hills, where Coal has been discovered at various points described in the reports and proceedings of the Coal Committee. An excavation was made to a depth of 40 feet in the Sultanabad district, on the banks of the Burmany, a small stream which falls into the Baugarutty at Moorshedabad, where the beds corresponded in every way with those of Burdwan. Still further in the same direction from Burdwan, Coal-beds have been discovered at Hurra and Sicrigully, at the north-eastern extremities of the Rajmehal hills. In the valleys on the opposite side of the same chain of hills the Coal fields of Palamow, Sohagapore, and other districts occur, connecting the Gangetic Coal fields with those of the Nerbudda.

SYLHET COAL FIELD.

Under this head may be included several unexplored indications of Coal in workable beds that have been discovered along the base of the Kasyah Mountains as well as the bed generally known as Cherra Ponji Coal. Here the Coal district, instead of being confined to the base of the mountains as in Burdwan, partly occupies

occupies broken summits of adjoining mountains at an elevation of 5,000 feet; while detached masses are found at various altitudes between these summits and the plains, thus showing that the whole has been subject to an eruption or upheavement which must have taken place soon after the close of the secondary or early part of the Tertiary Period; for the acclivities of the mountains, consisting of broken and dislocated beds of sandstone, are covered with the latest secondary and early tertiary marine remains. The only bed of Coal that has as yet been worked in the Sylhet field is one of the broken detached masses, forming the summit of a mountain at Cherra. The peculiarities of this formation have already been noticed. It remains merely to refer to plate 2 (first Reports of the Coal Committee), representing a few of the most characteristic fossils it contains. These are exclusively shells from the limestone situated beneath the only workable bed. The reason of the absence of Coal plants here is, that they are generally most abundant in the upper beds of the Coal formation, and particularly in the shale. The shale, as well as the whole upper portion of the series of Coal-beds, is here removed by denudation, and the lower bed of Coal alone remains, covered merely by a deposit of clay and loose sand.

ASSAM COAL FIELDS.

Regarding the extensive deposits of Coal in Assam, nothing whatever is known in a scientific point of view. All we know on the subject of their economical value will be found in the reports under that head. The most recent discovery of interest that has been made is that of Mr. Bedford, Revenue Surveyor, employed under Captain Jenkins, the Commissioner of the province, of a bed of Coal in the Caribari hills. No good specimen of this Coal has as yet reached Calcutta.

ARRACAN.

Extensive deposits of Coal have been found in Arracan, but, like those of Assam and Sylhet, we have no scientific information regarding them, nor is any more known regarding the Coal of Tenasserim province. For whatever of economical value that has been gleaned regarding these Coal districts, we must refer to the reports and proceedings of the Committee.

NERBUDDA.

With regard to the Coal fields in the Nerbudda, beyond the fact of the existence of Coal near Hoosungabad, as well as Jubbulpore, there is little or nothing known. The limestone alluded to in several communications from that quarter will probably prove to be that of the Coal formation. Descriptions of the fine compact limestone, and the sandstone slates at Jawud, west of Oodeypore, by Captain Dangerfield and Mr. Hardy, apply unquestionably to the limestone and the sandstone of the Coal formation.

Captain Dangerfield himself regarded the limestone as the equivalent of the English mountain limestone, and Mr. Hardy, for no very good reason, considered it to be lias, while the hard bituminous and micaceous sandstone, containing the impressions of ferns, associated with the limestone was considered by both authors as equivalent to the saliferous marls; but at the time of their inquiries, Coal-beds had not been discovered in this quarter, so that the authors may be excused for overlooking the real nature of these rocks.

Whenever the demand for Coal at Bombay may render renewed inquiries for its discovery in Western India desirable, researches should be commenced in the Nerbudda Coal Districts, and extended from thence to the westward, carefully tracing the "saliferous marls" and limestones of Dangerfield and Hardy from Malwa to the westward, having first established their true relative position to the beds of Coal in the Nerbudda.

OLD RED SANDSTONE.

In all parts of the world the Coal formation rests on deposits of great depth, consisting of sandstone and conglomerates, forming the old red system of Murchison; to this there are exceptions, which may always be explained by local peculiarities of certain districts.

The rocks comprised under this head have been hitherto regarded as forming a section of the Coal formation, but Mr. Murchison has pointed out the claims of these beds, both from their extent and organic contents, to rank as a distinct system of rocks, exhibiting the changes peculiar to a long period immediately anterior to the commencement of the Coal formation.

The depth of the sandstones underlying the Coal of the South Welsh Coal Basin is supposed by Mr. Murchison to be little less than 9,000 feet. In India there is an equal development of sandstones immediately below the Coal formation at Cherra Ponji, but in other Coal districts the old red sandstone sometimes consist merely of a few beds of conglomerate. These sandstones in India have not yet been investigated to that extent which the importance of the subject demands. It is only where they are found in contact with Coal formations that their real character can be well established until we are better informed as to the nature of their fossil contents in India. In Europe these consist almost exclusively of the remains of marine animals, chiefly fishes. Plants of any kind are rare, except in the upper strata, where the formation passes into the Coal measures. The great depth of the deposits, and their almost exclusively sedimentary character, afford evidence of these beds having been derived from other pre-existing rocks, and deposited again in the deep basins of seas, by causes similar to those which are now in progress. A formation of this nature will necessarily partake of the characters of the rocks from which it was derived, and differ essentially in its mineral characters in different places. Thus felspar and quartz derived from the gneiss of the great central masses of the Kasyah hills, enter largely into the sandstone forming the basis of the Coal formation at Cherra Ponji. Whether an investigation of the beds at Cherra would be attended with similar results to those deduced from their investigation in Europe by Mr. Murchison, is a question that remains to be proved. The following are the results of Mr. Murchison's observations:—

The old red sandstone consists of various strata of conglomerate, sandstone, marl, limestone, and tilestone, the newest beds of which dip conformably beneath the Coal formation, whilst the oldest repose upon and pass into certain grey coloured rocks, which form the upper part of the Silurian system.

Convinced that the old red sandstone is of greater magnitude than any of the overlying groups, Mr. Murchison applies to it the term of "system," which in geology now implies various groups or formations of strata, indicative of so many distinct periods.

The reason why the old red sandstone has not been regarded as a distinct system, Mr. Murchison thinks, is that in France and Germany its equivalents are ill, if at all developed. It has, however, been recognised in Poland and Silesia; while in Norway there are mountain ranges very similar in structure to the old red sandstone of the North of England, Scotland, and Ireland. There is a sandstone in India corresponding with the old red in England, occupying the same relative position to the Coal measures, and presenting the same lithological characters; but how far its zoological contents will be found to correspond with those of the English rock, is a subject that must be decided by the observations of geologists in India.

We have endeavoured in another place* to put the Indian student in possession of the principal details brought together by Mr. Murchison, in that part of the British Isles of all others best calculated to afford the true distinguishing peculiarities of the old red system as it occurs in the Western World.

Nor is Mr. Murchison's observations confined to this field; they are also extended to Shropshire, where a similar succession of the old red sandstone is displayed, as well as to Herefordshire, where the same rocks compose a great basin,

basin, the lower strata of which are turned up on both flanks against Silurian rocks.

This ample field may be taken as the fairest example presented by the old red system in Europe; and Mr. Murchison's observations afford not only the latest, but the safest standard with which to compare the results of our observations on such rocks in India, as far as they appear to be representatives of the old red sandstone in Europe. Mr. Murchison divides the old red system into three divisions, as follows:—

1. Quartzose, conglomerate, and sandstone.
2. Cornstone and marl.
3. Tilestone.

“In the descriptions which follow, it will be seen,” says Mr. Murchison, “that the distinctions implied by these names are not absolutely peculiar to any one of the three divisions. Thus fossil beds occur, partially, both at the bottom of the first and in the middle of the second division, while conglomerates sometimes take the place of tilestone in the lowest strata.

“The conglomerate forms the uppermost beds of the old red sandstone on the southern face of the Carmarthen and Brecon Mountains, and consist of white quartzose pebbles in a red matrix.

“The stratum dips beneath the carboniferous limestone, where it often assumes a slightly calcareous quality in the cement, with pink and white nodules of quartz, from the size of mustard-seed to two or three inches, sometimes mixed up with grains of a green compact felspar; other and lower beds are, however, pure quartzose conglomerates.

“When fresh quarried, the conglomerate is sometimes of a pink or reddish colour, but after long exposure it frequently becomes nearly white, in which state it might be mistaken for the coarser beds of millstone grit, but it is separated from them by the carboniferous limestone. The conglomerate beds occupy a thickness of about 200 feet, and pass down into chocolate-brown and reddish coarse-grained sandstone, with blotches of red shale, and occasionally a very small pebble of quartz. Below, the conglomerate usually becomes finer, and passes into a pure sandstone of brownish and occasionally gossling green, and deep red colours; other beds are much spotted with green blotches on a dark red ground. Where roads are contiguous, this sandstone is quarried for troughs, cider presses, and building purposes, and some of the lower layers of this division are so fissile and fine-grained, as to allow of their being quarried for flagstones and grindstones. These rocks are distinguished from the next division of the system by the absence of calcareous beds.* In some of the ridges where the lower beds pass into cornstone and marl, thin layers filled with fragments of carbonised vegetable matter have been found, but never in so perfect a form as to resemble fossil plants. These appearances have induced ill-advised speculators to drive galleries into mountains of this rock in search of Coal.”

These sandstones assume a very ancient aspect. “We must not however,” says Mr. Murchison, “judge of the antiquity of rocks by their mineral aspect, nor even by their lithological structure; for, as I shall have occasion to show, there are many portions of the old red sandstone undistinguishable in these respects from the oldest grey wacke, whilst strata of the underlying Silurian system, formerly termed grey wacke, so far from assuming an air of high antiquity, in numberless cases, and over very large areas, resemble closely some of the younger secondary deposits.”

The uncertainty connected with the relative position of rocks in districts not regularly investigated, must expose all casual observations on the identity of structure in remote situations on the earth's surface to serious difficulties.

To compare one district, the peculiarities of which have been thoroughly investigated, with another, but partially known, in a remote part of the world, we have not only to be on our guard against various forms which the same rocks are liable to assume under different circumstances, but we have also to recollect, that

* Very rarely, Mr. Murchison remarks, where this upper division of the old red sandstone is much expanded, it occasionally contains thin courses of mottled, red and green, very impure limestone, not to be distinguished from some of the least calcareous beds of cornstone. In one of these beds Mr. Murchison discovered the scale of a large fish not yet described.

that the laws of geographical distribution of animals should prevent our expecting to find the same organic remains everywhere in the same rock.

In the first reports of the Coal Committee, we stated our reasons for regarding the beds of sandstone which form the basis of the Coal measures at Cherra Poonjee to be equivalent to the old red sandstone. The relative position of the beds in question to the Coal formation, as well as their lithological character as far as we are acquainted with them, are in favour of their belonging to the upper group of the old red sandstone, which formation, according to the observations of Mr. W. Jameson, not yet fully before the public, is largely developed in the north-western parts of India.

There is really nothing in the name that ought to deter us from using it to designate a formation agreeing, at least in all its main characters, with the English rock, and occupying the same relative position between the Coal measures on the one side, and the more ancient rocks on the other.

The second division of the old red sandstone, according to the observations of Mr. Murchison, is the

CENTRAL OR CORNSTONE FORMATION.

The central masses are chiefly composed of alternations of red and green argillaceous spotted marls, affording rich soil. These argillaceous beds sometimes alternate with sandstone, but more frequently with irregular courses of concretionary impure limestone, mottled also red and green. When compact, the calcareous beds are termed limestones by the quarrymen, but when mixed with sand and marl, giving them a brecciated or conglomerate aspect, they constitute the well-known cornstone of Herefordshire and the adjoining counties.

The strata consist of deep red shale, argillaceous sandstone, and hard quartzose, dingy, purple or brown sandstone, slightly micaceous, with intercalated calcareous beds of concretionary structure, varying in colour from red to green, and the concretions (in diameter from half an inch to three or four inches) disseminated through a mottled marl or impure limestone.*

These beds are from 8 to 30 feet deep; the impure concretionary limestone is of very irregular dimensions, contracting and expanding in thickness often in the most capricious manner. Its colour is green, blue, and red; its composition is often sufficiently pure to allow of its being burnt for lime; at other times these beds are only used for road making.

TILESTONE.

These beds constitute the lowest of the three divisions into which, according to Mr. Murchison's investigations, the old red sandstone is separated. Its upper beds pass into cornstone and marls, and the lower change into the Silurian rocks of this author, which it sometimes overlaps.

The distinguishing characters of the tilestone beds are thin, finely laminated, hard, red, purple, or green micaceous sandstones, which split into tiles. These beds are associated with reddish shale; the decomposition of the whole affords a red soil. The organic remains of this division are numerous, and consist of *Arca*, *Avicula*, *Belorophon*, *Cucullæa*, *Lingula*, *Orthoceros*, *Terebratula*, *Turbo*, *Turritella*, *Trachius*, *Tentaculites*, *Scalaris*.

The trap-dykes, which are so common in the Coal formation, are particularly rare in the old sandstone, a circumstance of much importance, and first, we believe, pointed out by Mr. Murchison, and which of itself goes far to establish this author's views regarding the independence of the two formations.

As the Coal formation is overlaid by one red sandstone, and underlaid by another, it is necessary that both these formations should be well understood and characterised in India, so as to know where inquiry for the discovery of Coal may be directed with the best chances of success, and also to appreciate correctly the value of indications of Coal when they have been discovered, and to determine whether such indications belong to the upper or the lower beds of the Coal formation. In the one case, valuable beds of Coal would be found on sinking mines into the subjacent strata; in the other such an operation would be a waste of time and money.

* These sandstones often expose on their surface blotches, prominences, and depressions of circular and party-coloured forms; some spots being softer than others, on exposure, the rock displays a corroded appearance.

ASSAM.

Assam, 1838.

CAPTAIN VETCH, in a letter to the Commissioner of Assam, dated 25th November 1837, mentions having found detached specimens of various kinds of Coal in the Jellundee, Belseeree, and Booroolee Rivers, that fall into the Bramaputra from the Bootan Mountains, between the 92d and 93d degrees of east longitude, at various distances from 14 to 20 miles from their confluence with the main river, and not far from the foot of the mountains.

The situations in which these specimens were found by Captain Vetch are marked by the letters A, B, C, on the annexed sketch-map of the Coal Districts in Assam.

The great number of more advantageous situations in which Coal has been found in Assam renders the question as to the quality and precise situations of the beds, respectively, from whence Captain Vetch's specimens were obtained a matter of secondary importance; but a proof so unquestionable of the existence of Coal at different points for an extent of at least 40 miles along the foot of the Bootan Mountains, connected with the fact of its having been discovered in a similar way, by the late Mr. Scott, on the banks of the Teesta River, at the foot of the Sikkim Mountains, three degrees less to the eastward, tends to encourage the hope of finding Coal in the lower ranges of the same chain, in some situation in which it may be available for useful purposes.

Regarding Captain Vetch's specimens, Captain Jenkins observes:—"These discoveries of Coal on the north bank of the Bramaputra, and over a tract of country 50 miles in length, appear to me to add greatly to the importance of previous discoveries of Coal on the south banks of the river; for I conceive it may be presumed that we have by no means obtained a knowledge of the full extent of the Coal beds in Assam, and that it is not improbable that they are co-extensive on both sides of the valley, and will be found nearly throughout its whole extent."

To understand the value of the other more useful discoveries of Coal that have been made in Assam, subsequently to the publication of the last Reports of the Committee, it is necessary to examine the value, in a practical point of view, of what has been previously made known on the subject.

Captain Henderson refers to six places at which Coal had been found, indicating the existence of an extended line of Coal districts from Gowhatty to Bramakund. However probable this may be, we have as yet done little to develop the fact, so as to render it practically useful; and in all inquiries of this kind, it is no less important to point out where information is defective than it is to bring forward successful results.

If we suppose an extensive series of Coal districts to exist in Assam, corresponding with the numbers marked on the sketch-map already adverted to, the more western beds, from their vicinity to Bengal, are entitled to our first consideration.

As to No. 6, however, the most western of all, and supposed to be situated on the Kopili River, within 60 miles of Gowhatty, we can find no information; so that the existence of Coal at this very desirable point rests merely on a specimen having been found in the sands of the stream by Mr. Hudson.

Of the next Coal, No. 5, we have a very clear and distinct account, as far as it goes, in a letter from Ensign Brodie to Captain Jenkins, dated 17th May 1837, which we can do no better than give at length. Ensign Brodie observes:—"With reference to your letter of 23d March, I have the honour to forward you a sketch from Mr. Hudson, showing the spots where Coal has been found within this division (Nowgong); they are three in number, but the only bed of Coal the site of which is known, is that on the Jumoona, a little above the falls. I went to this myself during the last cold weather, and raised about eight or ten maunds, specimens of which I sent to you at the time. What I got did not appear to be of a very fine quality, having apparently a good deal of earthy matter mixed with it; but it is more than probable that if the vein were worked further, excellent Coal would be found. The thickness of the strata is about $2\frac{1}{2}$ feet. I laid the surface bare for some 10 or 12 yards, but how far the vein extends beyond this I am unable to say. I believe no difficulty would be found in working the Coal, if it ever should become an object of importance

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to do so. The population is certainly scanty, but then it is composed of a class of people (Mikeers and Kacharees) who can be taught, and will willingly put their hands to anything that will afford them a moderate remuneration for their labour.

“ The bed is situated at the foot of a small hill on the east side of a little nullah, which runs from the north into the Jumoona, about half a mile or three quarters of a mile above the falls of the latter, the distance of the Coal from the Jumoona itself not being more than 80 or 100 yards. This river is at all times navigable to the falls by canoes, and two or three of these lashed together can take down a considerable cargo. The river is deep again above the falls, so that it is only for about 300 or 400 yards over these that porters would be required: a boat from Gowhatty would, on an average, reach the falls in 20 days, and return in 10; but this would vary with the season.

“ Pieces of Coal of good quality have been picked up by myself in the bed of the Nambua, a small stream running into the Dhunseree from the west, but we have no information as to the position of the beds.”

The locality of these last fragments is marked No. 4 in the annexed sketch-map; and beyond the specimens picked up by Ensign Brodie, we have no further evidence of the existence of Coal at the place in question. Here, then, is the sum of all we know regarding Coal in Lower Assam, the particular part of the province in which, if found in sufficient quantity and of good quality, it would most favourably compete with the Coals of Bengal in the Calcutta market. It is desirable, therefore, that the indications of Coal in this quarter should be thoroughly investigated. Captain Jenkins, impressed with the importance of this, has made repeated efforts to have the district examined, and when the Scientific Mission was in Assam, he directed Dr. Wallich to detach one of the members of the mission for this purpose, which was accordingly done, and eight days were allowed for the duty; but this period being too short even to reach Lower Assam from the place at which the order was given, it is needless to say the investigation was not undertaken.

The next Coal noticed in the sketch-map, No. 3, is that which has been longest known, a large quantity of superior Coal having been raised from this bed by Mr. Bruce in 1828.*

† Probably canoes,
6 D.

It is situated on the Suffry, an impracticable tributary of the Disung, but at what distance from the latter does not appear in the account given of the place by Mr. Bruce, who lost several boats† in his attempt to reach the site of the Coal. There is a small range of hills which offers some impediment, but Mr. Bruce states that it might be overcome by widening the pass, and by the formation of a road for hackeries. Inferior Coals were observed by Mr. Bruce, crossing the bed of the stream in different situations, so that if these last beds should be found to afford good Coal, the difficulties would be considerably less in reaching it there than in the higher situation; but in so remote a part of Assam as this, perhaps no Coal would be worth working, unless it occurred under more favourable circumstances for transmission than characterise any of the Suffry beds.

The Namroop Coal, No. 2 in the annexed map, first observed by Lieutenant Bigge and Mr. Griffith, though, like the last, of excellent quality, and the Brumakund Coal, No. 1, found by Captain Wilcox, are probably beyond the reach of being profitably worked and introduced to the navigable part of the Bramaputra; so that of the six localities in which Coal had been found in Assam, at the time the preceding Reports of the Committee were written, one situation only (Suffry) was known from whence Coal might be obtained (and that with some difficulty) for local consumption in the province, at a cheaper rate than it could be supplied from Bengal.

Having thus stated what had been done up to the period at which our last Reports were published, we are the better prepared to show the value of what has since been done in Assam. Coal has been found by Captain Jenkins himself at Boorhath on the banks of the Disung, the main river to which the Suffry Coal had to be carried over so many difficulties. By this discovery, therefore, all these are at once obviated.

Another

* A sample of it was tried at the Mint, and found to be equal to Cherra Poonjee Coal.

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* Journ. 1838,
pp. 169 to 368.

Another Coal bed has been found by Captain Hannay near Jypoor, about 12 miles north-east of Boorhath and within three miles of the Boree Dihing, also an excellent river. Full details regarding each of these discoveries having been published in the proceedings of the Asiatic Society for February last,* it is unnecessary to enter into them here, further than concerns the extent of the beds and the quality of the Coal.

At Boorhath, beds occur in two situations—first, close to the channel of the Disung, at the commencement of a rising ground about a mile from the village of Boorhath. This bed is described by Captain Jenkins as visible, for about 100 yards in length and eight feet in thickness, above the water and gravel of the stream.

The second bed is about a quarter of a mile distant from the Disung, at an elevation of about 50 or 60 feet, and exposed to the extent of 200 yards in length on the bank of a little watercourse. It was not visible in continuous masses, being concealed here and there by rubbish fallen from above; but it cropped out, says Captain Jenkins, at intervals, and always seemed to bear a thickness of several feet. The Coal in both these beds appeared to Captain Jenkins to be of first-rate quality, and nothing could well be more favourable than the position for working, nor for the transport of the Coal as far as the waters of the Disung admit; but this stream is barely navigable for laden canoes of small size in the dry weather, although in the rains it has a depth sufficient for large boats, and its stream is nowhere impetuous.

The situation of this Coal is about 50 miles from the confluence of the Disung with the Bramaputra, so that laden boats might descend during the rains with ease from the Coal beds to the great river in three days, and return in six. The point at which the Disung joins the Bramaputra is about 180 miles above Gowhatty.

The Jypoor beds are described in a letter from Captain Hannay to the Commissioner of Assam, under date 1st February 1838.† Captain Hannay states in this

† In a subsequent letter to Major White, dated 15th September last, Captain Hannay gives the following particulars regarding the manner in which the Coal occurs, and how he raised it: "The vein which I excavated is situated one-and-a-half mile in a south-easterly direction from Jypoor. It was close to the right bank of a small nullah, which winds its way into the plains and has its rise in the small hills which run along the foot of the Naga Mountains. The bank is not steep, and for a distance of from 300 to 400 yards it is tolerably straight, rising gradually from 80 to 100 feet in height from the spot where the vein is first visible; for a distance of 30 yards the direction is about 205°, when it turns to 190°, and is visible further than it has been excavated by me. Proceeding onwards, however, in a direction of about 160°, and at a distance of two furlongs, you pass over a bed of greyish coloured, soft, shaly sandstone, strongly impregnated with petroleum; and a little further on, there are several springs of this mineral oil issuing out from the description of sandstone above-mentioned, and in the open spaces the surface of the ground is covered with clay-shale and Coal, well trodden down by herds of deer and elephants. A little farther on in the same direction you come upon another rivulet, running west, and intersecting a vein of Coal which is probably a continuation of the one worked by me, and it is here visible in a mass of 11 feet in height and as many in breadth. My observations on this vein did not extend further than this, but on proceeding down the nullah, and also in the southerly direction about six furlongs distant, there are several veins of Coal trending in a direction of 335°, the line of dip being 280°, and at an angle of 45°, thus dipping directly into the centre of the hillocks. I could not work on what (in miner's phrase) is termed the face of the mine, without being at considerable expense in removing such a mass of upper soil, for which I had not a sufficient number of the requisite implements; and I was consequently obliged to work directly down upon the vein, and from this circumstance, added to the tender nature of some portion of the Coal, there was unavoidably a good deal of waste. The annexed sketch will perhaps show more distinctly the situation of the vein and its accompanying strata. The method I adopted in digging was as follows: Having cleared away the surface soil, I ascertained the exact stratification of the sandstone, and having dug in the direction of the partings to the depth of 16 inches or two feet, I cut with axes to the same depth across the vein, and the blocks thus turned out I raised by means of wedges, levers, &c. the best way I could. As might have been expected, I did not find the Coal of an equally good quality throughout, at least with regard to hardness and compactness of texture, that which was uppermost being much impregnated with ochery earth, whilst under this lay the hardest and finest specimens, the blocks breaking off large, and the fracture exhibiting that beautiful iridescence said to be common in Newcastle slaty Coal. Below the last-mentioned description, and as far as I dug down into the vein, which might have been about six feet, the Coal was of a softer nature, intermixed, however, with many lines of hard; thus exhibiting the variety of fracture found in Coal, the trapezoidal and rhomboidal mixed in the harder with cubical fragments, and the whole exhibiting what is called by miners "bright heads," having the white shaly concretions and rusty scale visible in every fracture. The structure of the whole vein is cubical, but the outer layer of Coal to the left is somewhat different from the rest, the texture of it being the same throughout, and its fracture being exactly similar to that of a slice of wood cut from the stem of a tree, and then broken in a contrary direction. It is not so thick as the other layers, and there is no intervening

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this letter, that since his arrival at Jypoor, he discovered several beds of workable Coal, and having been directed to forward a few hundred maunds to Calcutta for trial, had already commenced clearing a large vein about two miles distant. "As I wished to collect the Coal at as little expense as possible," Captain Hannay observes, "I selected the vein nearest to Jypoor; and before I came to this determination, I employed myself in exploring the neighbourhood, and have been very successful in finding Coal and iron in great plenty." As the sample, consisting of 224 maunds, has not been found of so good a quality as the Assam Coal that had been previously sent down to Calcutta from the Suffry beds, we have annexed in the preceding note the whole of the details given by Captain Hannay of his operations.

It would perhaps have been better, on such an occasion, if samples of different kinds had been transmitted, rather than a selection of that which, from its hardness, seemed to be the best; indeed, it may be doubted if hardness in Coal denotes a superiority, and if the circumstance noted by Captain Hannay, of the bed becoming somewhat softer the deeper the excavation was carried, be not a very favourable sign.

We are not, however, to expect that a first sample, from the outcrop we may say, of a single bed in a new and extensive Coalfield, should be of a first-rate quality. The only fault of the sample of this Coal selected by Captain Hannay is that it contains a considerable quantity of sulphur, which, from trials made at the Mint, appears to render it unfit for annealing silver, and that 40 maunds are only equivalent to 32 maunds of the variety of Burdwan Coal in use at the Mint at the time, for getting up steam. Captain Forbes is, however, of opinion, that this sample of Assam Coal would be found nearly as good as Burdwan, when burned in the comparatively small furnaces of the boilers of steam-vessels.

Quality of Jypore
Coal, and opinion
of Captain Forbes.

As far as the Assam Coals generally have been tried, their qualities have been found to be so good, that we may regard the small cargo transmitted to Calcutta by Captain Hannay, as chiefly valuable in showing the facility with which the article may be raised and transported. Captain Jenkins, in enclosing the bill of expenses incurred in raising and transmitting a boat-load of Jypoor Coal to Calcutta, observes:—"I need not point out to the Committee, that this attempt to work the Coal beds in the neighbourhood of Jypoor has been made under very unfavourable circumstances; the greater part of the last dry season had passed away before Captain Hannay was able to commence operations; indeed, the rains had commenced prior to any Coal being brought from the mine; but notwithstanding this drawback, Captain Hannay succeeded in raising 1,050 maunds of Coal, and conveying to the mouth of the Booree Dihing upwards of 800 maunds, the whole expense of which amounted to Rs. 96. 5. 6., so that the Coal has been brought down to the confluence of the Booree Dihing with the Bramaputra, at something less than two annas a maund."*

Boorhath and Jypoor, the places at which the Coal beds just noticed are situated,

Relative advantages of Boorhath and Jypoor Coal beds.

shale between it and the tough clay which lies upon it. This layer is also much impregnated with mineral tar, which has an aromatic odour, and in several of the masses of Coal belonging to it I found a rich, yellow-coloured, fine clay, having the appearance of orpiment. It will be observed by the accompanying sketch, that I had no hard or rocky substance to encounter, which is a great advantage both with regard to expense and facility in working. I only worked the Coal to the extent of 15 yards in the length of the space, and six feet in depth; and although I found a good deal of ponderous slaty substance, much impregnated with pyrites, on which pickaxes struck fire, still I did not come upon rock; and to all appearance the vein of Coal may extend many yards further down. The breadth of the vein, including the partings, is about nine feet, and the loss in digging must have been about one-third of the whole quantity excavated. On examining the beds of two watercourses which pass over the vein of Coal, and which come from the summit of the hillocks, I found several beds of sandstone of the description called by the miners whitepost; it is soft and easily broken, and was intermixed with large masses of iron ore and soft red sandstone; and there were also two small veins of Coal, which, although several feet higher than the larger vein, evidently appeared to belong to the same bed, having the same dip and bearing. In the beds of these watercourses, and also throughout this low hilly tract, there are found large pieces of petrified wood round pieces of white quartz, and worn fragments of mica slate, having quite the appearance of a salt-mine."

* In concluding this letter Captain Jenkins observes—"It gives me much pleasure to bring to the notice of Government, through the Committee, the zealous manner in which Captain Hannay, at considerable risk and trouble, has co-operated with me, not only in this instance, but in every other where an attempt has been made to develop the resources of the Eastern Districts of Assam."

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situated, are laid down in the annexed sketch-map between No. 3 and No. 2; the advantages of the former beds over the latter in regard to situation may also be seen in this map, the Jypoor River joining the Bramaputra 18 miles higher in Assam than the river on which the Boorhath Coal would have to be carried. Besides, this Jypoor Coal is situated from $1\frac{1}{2}$ to 3 miles from water-carriage, while boats may approach at Boorhath to the mines. Nevertheless, these differences are so slight, that a preference to one or other locality must depend on its comparative healthiness, on the quality of the Coal, and on the general capabilities of the place.

Of the healthiness of Assam generally, people now begin to form very favourable notions compared with Bengal. Boorhath and Jypoor are said to be situated in one of the finest quarters of the province. In the present state of things, perhaps, the Boorhath and Jypoor Coals are only to be regarded as the elements of local improvement; the intercourse between Upper Assam and other parts of India must assume a better footing, before its Coals could be supplied to Calcutta at a cheaper rate than Bengal Coals; but whether the former might not compete with the Burdwan Coal in the supply of the dépôts on the Ganges, unless the present prices of the latter can be considerably reduced, and whether it would not be advisable, considering the local improvement to which such an arrangement would give rise, to adopt measures for supplying the Gangetic steamers from this quarter, even though no direct saving were at first to be expected—such a question it is not perhaps the business of the Committee to examine into, still it is one of so much importance, and so intimately connected with the practical results of its proceedings, that we may be pardoned for alluding to it in detail.

Advantage of obtaining Coal from the eastward for the supply of the Gangetic steamers.

The rates at which the following stations are supplied under the present contracts, which will expire on the 26th of July next, are as follows:—

	<i>Rs.</i>	<i>a.</i>
Cutwa- - - -	55	8 per 100 maunds.*
Berhampoor - - -	56	- " "
Kulna - - - -	54	- " "
Comercolly - - -	64	- " "
Surdah - - - -	70	- " "
Golgong - - - -	70	- " "
Rajmehal - - - -	67	- " "
Monghyr - - - -	74	- " "
Dinapoor - - - -	80	- " "

(Average, *Rs.* 67. 7. 6., or *Rs.* 654. 11. per 1,000 maunds.)

But as the Bhagirutty and Sundurbun courses are only used alternately by the regular steamers, the quantity of Coal consumed annually at the four first dépôts, can only be equivalent to the quantity consumed at two of the others; the true average price of the Coal consumed will therefore be *Rs.* 67. 13. 2. per 100, or *Rs.* 678. 13. 9. per 1,000 maunds. Considering the proximity of the two first dépôts, Cutwa and Berhampoor, to the Adji and Rajmehal Coals,† and the Kulna and

* *Note by Captain Johnston.*—These charges include the landing, storing, and delivering the Coal from the dépôts to the steamers, and all loss by defalcation or other causes. The contractors are not paid for the quantity of Coal they despatch, but only for that which they deliver, free from dust and small Coal, on board the steam-vessels.

† Regarding the Adji Coals, Mr. Erskine observes in a letter, dated 6th November 1838, to the Coal Committee: "It would be impossible to say how much Coal might be got down to Cutwa during an average season, and it would be equally rash to give a tender for the supply of a stated quantity, or to depend on such a contract, till the navigation of the Adji has been put to the test of experiment." In another part of the same letter Mr. Erskine remarks that "Government could not depend on a larger supply than 10,000 maunds in one season, till the navigation of the Adji has been tried, and then states that, "If 40 rupees per 100 maunds could be offered for the Sheergurh" (which is the best Adji) "Coal, a much larger supply might be brought to Cutwa than that above-mentioned, by employing carts to bring down the Coal to the lower Adji ghats during the dry season, making the carriage from thence in boats less precarious." Mr. Erskine adds, that he should be happy himself to undertake the delivery of Coals at Cutwa for a year, by way of trial, should no one else offer to do it on more favourable terms. The Rajmehal Coal discovered by Mr. Pontet will, that gentleman thinks, cost at Berhampore about six annas per maund; but further particulars require to be known regarding it, before any reliance can be placed on receiving supplies from this bed.

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and Comerciolly depôts to Sylhet, the most economical arrangements that could be made for their supply would certainly be with persons connected with the mines in each of those districts, who might be requested either to furnish tenders, or to make such other arrangements, by way of experiment, as might seem most efficient for securing so small a supply as that required on the Bhagirutty and Sunderbun lines.*

This would leave the higher stations to be supplied on a separate contract from Burdwan, or any other source from which it might be done cheapest. The average charge for Coal at the five depôts from Surdah to Dinapoor is at present Rs. 72. 3. per 100, or Rs. 721. 14. per 1,000 maunds.

The entire consumption for the past year has been about 91,000 maunds on the whole line from Calcutta to Allahabad; but should the number of steamers be increased, the expenditure of Coal must also increase in the same proportion, and the supply would in such case become, in every sense, an object of more importance.

Boats of any draught would have a favourable current throughout the year from Disung Mookh on the Bramaputra to Surdah, with the exception, during the dry season, of about 80 miles from Jafirgunge to Surdah; they would thus be enabled to reach Surdah, one of the depôts for Coal, in about one month, say even six weeks, from the date of leaving the Disung River. Returning unladen for fresh cargoes, they would be about two months, thus making three trips in the year with the greatest ease, inclusive of the time required for taking in and discharging cargo.

The following are the rates at which boats are hired by the Commissariat for the conveyance of public stores, and though higher, perhaps, than those which merchants pay, may be taken as established charges, at which any extent of tonnage may be had. The boats required for this duty should each carry at least 1,000 maunds:—

Hire of boat, at 3 rupees per 100 maunds burden, per	Rs.	a.	p.
mensem † - - - - -	30	-	-
1 Majee, at 5 rupees per mensem - - - - -	5	-	-
15 Boatmen, at 4 rupees each - - - - -	60	-	-
	95	-	-

Or, 1,140 rupees per annum, to which must be added insurance, which to Gowhatty is $3\frac{1}{2}$ per cent.; and there is nothing in the navigation of the Bramaputra for 200 miles above Gowhatty, to increase the risk beyond that of an equal distance on the Ganges; insurance would therefore be, on three trips, Rs. 52. 8., which, added to the annual cost of the boat and men, gives Rs. 1,192. 8. To this sum must also be added the original cost of raising and conveying the Coal from the pits to the Bramaputra; this, according to Captain Henry's experiment, is two annas per maund, which for 3,000 maunds would be 375 rupees, making in all for 3,000 maunds of coal delivered on any part of the Ganges, from which three trips might be annually made to Assam, Rs. 1,537. 8., or Rs. 512. 8. per 10,000 maunds; being Rs. 209. 6. less than the rate at which the depôts from Surdah to Dinapoor are now supplied‡.

Perhaps

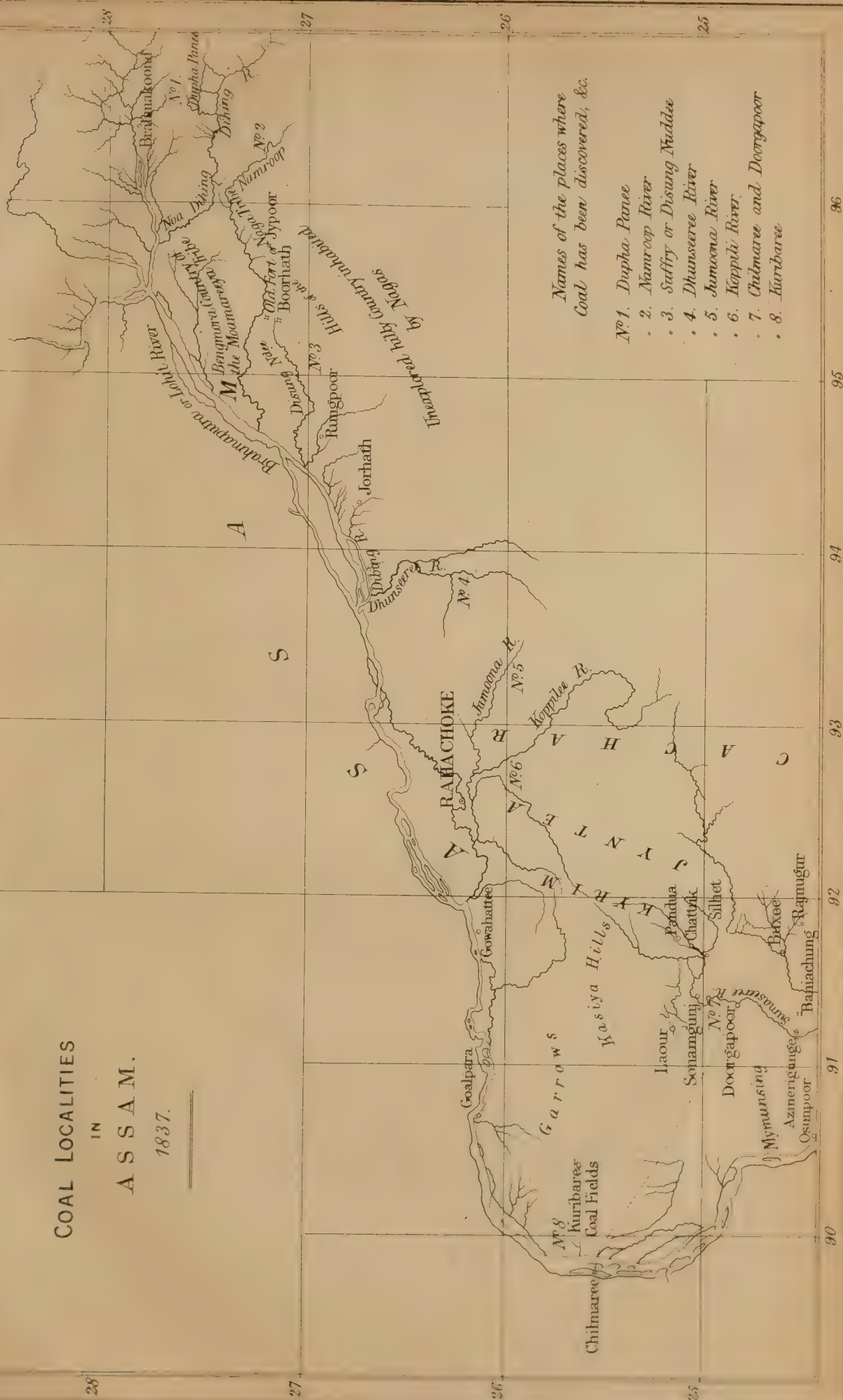
* Mr. George Loch, at the time Deputy Collector of Sylhet, calculated the expense of delivering 100,000 maunds of Cherra into boats at the foot of the hills at 24,800 rupees, or about 25 rupees per 100 maunds. To Cutwa, Berhampore, and Kulna, the boat-hire would be 7 rupees per 100 maunds, which would make the Coal cost about 32 rupees per 100 maunds at each of those depôts. (See Appendix 1.) The correctness of Mr. Loch's calculations has since been proved by the delivery of this Coal in considerable quantity by Major Lister.

† Note by Captain Johnston.—I believe this is for the measurement of the boat; a boat of 1,000 maunds will not carry more than 600 or 700 maunds weight.

‡ Major Henderson remarks, that the calculation here entered into does not provide for incidental expenses, including clashies' establishments, wastage, landing charges, custody, all which would somewhat

ASSAM.

1837.



Perhaps the most important results from opening Coal-mines in Assam for the supply of Gangetic steamers, until more convenient sources should become better known than at present, would consist in the assurance of an unlimited and steady supply at all seasons; and the widening of the field for competition, while the attention of natives being directed to a new and promising branch of trade, the measure would contribute largely to the local improvement of the province. Lieutenant Brodie, Principal Assistant to the Commissioner, found Coal of good quality, about a year ago, in a favourable position on the Disung River, a specimen of which was forwarded to the Committee in July last, and found to afford,—

Assam, 1838.

Specific gravity, 1·3.

Inflammable matter	-	-	-	-	-	40
Carbon	-	-	-	-	-	55
Earthy matter	-	-	-	-	-	5
						100

Recently, Mr. James Bedford, Revenue Surveyor, and other officers employed under Captain Jenkins, have discovered several situations in the Carribari Hills, in which Coal exists. For all the particulars as yet known regarding the Coal of this very desirable quarter, *see* proceedings of Committee, April and May 1841, and the proceedings generally for all that has been recently done for the development of the Coal resources of Assam.

somewhat increase the expense, though not very considerably: Captain Johnston therefore makes it out as follows:

	Rs.	a.	p.
Boat hire for 3,000 maunds of Coal, as per above statement	-	-	1,140
Cost of 3,000 maunds of Coal, at two annas per maund	-	-	375
Insurance at (3) three per cent.	-	-	45
Loss on Coal by two removals and 12 months' storing, 300 maunds;			
landing charge on 3,000 maunds	-	-	22 8
Re-loading and delivering 2,700 maunds at one rupee per 100 maunds	-	-	27
Sircar and peon's wages for 12 months, seven and five rupees	-	-	144
Ground rent and expense of shed, at six rupees per mensem	-	-	72
Total Cost of 2,700 maunds of Coal delivered to Steam-boat - Rs.	-	-	1,825 8

or 10 annas 9 pie per maund nearly.

Note by the Secretary.—The weight which boats may carry depends a good deal on rivers and seasons. In March and October it might be necessary to load boats lightly, but at other periods Coal boats from Assam might be laden, if necessary, to within six inches of the water, having such fine rivers to navigate; but if a 10,000-maund boat be too small, a 1,400-maund boat might be employed instead, with the same number of men, which would make a trifling difference in expense, but would give a great advantage in the results. Captain Johnston's calculation, which omits nothing that could be necessary, while other things are probably overrated, still leaves an advantage of 1 anna 3 pie per maund, in favour of the rate at which Assam Coal might be supplied to the stations, between Surdah and Dinapoor, compared with that now paid by the Government for Burdwan Coal for those stations.

The loss on Coal, by moving it from place to place, varies according to the nature of the Coal, and the number of removals; the latter cause would be at its minimum in the Assam Coal, as the same boat that would take it up in Assam could deliver it at the dépôt for which it might be intended, and where it is not necessary it should remain a year in store. A sirdar and peon more-over would not be necessary for every 2,700 maunds of Coal, but for all at the dépôt, which might be 20,000 maunds; the boatmen would be responsible for the Coal on board their own boat, and being measured out and into the boat, there would be no room for cheating. It is also too much to charge the entire expense of a shed to 2,700 maunds, when the same shed would answer for all the Coal required at the dépôt. Both statements, however, show that the Jypoor and Boorhath Coals might be introduced to the higher stations on the Ganges with considerable advantage; and if free passage to emigrants were offered in the return boats, with the prospect of employment, the present paucity of labourers in Assam would, by the intercourse which would thus be formed between Assam and the more popular parts of India, be soon remedied.

ARRACAN.

Arracan, 1840.

Kyuk Phyu Coal.

COAL has been discovered at Kyuk Phyu, in the northern extremity of the island of Ramree, near Oogadong, close to the anchorage of ships. It was first observed by Lieutenant Foley in 1833, and afterwards described by that gentleman and Captain Margrave (vol. 11, "Asiatic Journal," p. 595); the quality of this Coal is good, but the quantity, as far as it has yet been discovered, is deficient. In consequence of the impenetrable nature of the vegetation, inquiries have been conducted in the neighbourhood to a very limited extent; but as the character of the Coal itself, and that of the adjoining rocks agree with the ordinary appearance of the best Coal-fields, favourable hopes may be entertained as to the extent and value of the indications in question; what has been supposed to be the same vein has been found in two distinct situations four miles apart.

Kingtellie or Sandoway Coal.

At Sandoway, in the same district, Lieutenant Mackintosh found Coal in the Kingtellie neighbourhood; one specimen of this Coal mixed up with siliceous matter is said by Mr. Walters to form the substance of the entire hill (*vide* "Journal Asiatic Society," vol. 11, p. 264); iron ores are also said to occur here in considerable quantity. This great number of indications of Coal at various points along this coast, and the little we knew regarding them once suggested to a member of our Committee, they were all referable to a cargo of Coal once shipwrecked at Arracan.

The more we know of Coal, the more we are impressed with the fact, that it never presents false indications of its presence. There is hardly an instance, either in India or elsewhere, of its appearing at all, that it does not do so under circumstances to render it in the highest degree important to society; and although at first the quality and extent of the beds in any new district may be for a time doubtful, yet experience teaches us, that where these indications do not improve in proportion to the intelligence and enterprise directed to their complete development, the mineral is not true Coal, but a substance, the peculiarity of which is easily detected, as the brown Coal of English geologists. The samples of Coal we received from different parts of the Arracan coast, were such as to leave no question whatever as to the beds from which they were taken belonging to the true Coal formation.

Ramree iron ore.

Coal has been found composing a part of Oogadong, a small island opposite to the harbour of Kyuk Phyu, in two situations, not very far from each other. The sample supplied was much impregnated with pyrites; it was, however, a caking Coal, belonging to the true Coal measures. It would be a desirable object to try how far the Oogadong Coal might answer for the reduction of Ramree iron ore, which is very abundant. Red Hill being said to be composed entirely of an ore which was formerly worked to some extent by the Burmese, a small quantity of ore and Coal might be sent to Calcutta for trial, and if the result proved satisfactory, trials on a larger scale might be repeated on the spot, where experiments of the kind must always be cheaper and more satisfactory than when made at a distance. Coal has also been found on Paget, or Adam's Island, south of the Great Island, of Ramree. It has also been found in small seams in one of the Bolonga Islands, as well as near the beach at Sandoway; but the necessary information is wanting to enable us to conclude anything from these indications, beyond the fact of the existence of Coal, to a great extent, in the Arracan Provinces.

Hoong Coal.

The most promising bed yet found is one that was brought to the notice of the Commissioner, Captain Bogle, by Lieutenant Lumsden, who states that it was found about two years ago by persons employed in Coal finding by Captain Williams. This Coal occurs at a place called Hoong, near the head of a river, which descends from a range of hills on the southern extremity of the island, falling into the Sandoway channel. Mr. Lumsden states that large boats may approach to the very spot where the Coal is found. On visiting the spot, Mr. Lumsden found "an irregular vein of Coal, of about a foot in thickness, mixed with broken red sandstone, and on working below it, he came to a kind of *clay slate*, and eventually to water." Mr. Lumsden, however, states, that he was obliged from fatigue to leave the work to a native, who in a few days brought to him 120 maunds of Coal—a larger quantity than we should have supposed a native could procure in so short a time, under circumstances described by Mr. Lumsden. A sample of this Coal, consisting of four or five maunds, was brought to Calcutta by Captain Bogle, and tried in the Laboratory of the Honourable Com-
pany's

pany's Dispensary, and found to burn with a clear bright flame and very little smoke. The following are the results of its analysis:—

Arracan, 1840.

Specific gravity, 1.28	
Inflammable matter	40
Carbon	54
Ferruginous ash	6
	100

It is a free-burning Coal, giving out a strong heat, and would no doubt be found suitable to steam purposes, as it is quite free from the sulphureous impregnation which rendered the former samples of Arracan Coal objectionable. The want of more satisfactory information than we yet possess regarding Arracan Coal is much to be regretted, as there is no part of India in which good Coal mines could be attended with more advantage, whether we regard the situation on the coast, or the peculiar circumstances of the province itself. This district is chiefly known to Europeans by the mortality that took place there during the late war. Few are aware that within 20 miles of the town of Arracan, there is a fine elevated chain of mountains extending parallel to the coast, and affording no doubt as fine a climate as any part of the world, although the coast itself is low, and like many similar tracts in the North of Italy, and South of Europe, unhealthy. Let good Coal be once discovered in abundance in this fertile province, and the deadly effect of climate to persons exposed in miserable boats, or damp huts surrounded by swamps, will disappear, and the indolent streams become the track of steamers, perhaps to the very foot of the hills, which might thus become available as places of residence. Since the foregoing observations were written, Coal of an excellent quality has been found on Cap Island, opposite to the harbour of Kyuk Phyu, on the western coast; also on a small point of land Ramree Island, opposite to Cap Island. For both these discoveries the Committee is indebted to Colonel Hervey and to the kindness of Assistant Surgeon Hinton for communicating the particulars.

Cap Island Coal.

At Keang Dyeng, more to the southward on the western coast of Ramree Island, Coal has been discovered and a few bags forwarded to the Committee for trial, and proved to be the best Coal for steam purposes ever yet found in India. Keang Dyeng is only about four miles from the coast, and is situated near a creek navigable for boats of small size. The very excellent quality of this Coal renders it desirable that the extent of the beds and facilities for working them should be inquired into. This will now, perhaps be accomplished, since a miner, furnished with all the necessary implements, has been placed at the disposal of Captain Bogle, the commissioner.

Keang Dyeng Coal.

The Hoong Coal situated south of Ramree town, the capital of the island, has also been found to be of very excellent quality, and Captain Williams, the civil officer of this portion of the district, has found the Coal beds to appear in various situations, north and south of Hoong.

TENASSERIM PROVINCES.

THE annexed map will show at how many points Coal has been found in the Tenasserim Provinces, and at what points it is likely to prove of most utility. Coal has been found by Dr. Helfer at A and B, two situations above the falls of the Great Tenasserim, at a distance of eight and nine days' journey, respectively, from the town of that name; but the quality is inferior, and the situation quite beyond the reach of any mode of conveyance to the coast.

Tenasserim
Provinces, 1840.

Although the quality is excellent in a third situation in which the mineral has been found by Dr. Helfer at C, yet its distance from the coast is such as to render it of very doubtful utility on the Bengal side of the peninsula. A still more recent discovery, by a native, places us in possession of what would seem to be a more promising Coal, close to the banks of the Great Tenasserim river, and within 29 miles of the town of Tenasserim.

Coal found on the
Great Tenasserim.

Two reports have been addressed to the Commissioner of the Tenasserim Provinces.

Tenasserim
Provinces, 1840.

vinces on the above-mentioned Coal, one by Lieutenant Hutchinson, dated 6th May 1839, and the other, of a somewhat later date, by Dr. Helfer. From Lieutenant Hutchinson's Report, we learn that the position of this Coal is $12^{\circ} 21' 30''$ N. lat., and about $99^{\circ} 5'$ E. long.; or, by the course of the river, 29 miles from the town of Tenasserim, and 65 from Mergui, although its direct distance from the coast is only 28 miles.

The Coal is said by Lieutenant Hutchinson to form a thick bed, covered by three feet of "clay slate," and from 20 to 40 feet of sand, which is so tenacious as to require no propping where springs do not exist. In a subsequent correspondence on this subject, the Coal is described as within 10 feet of the surface, and from all we can learn, we have no doubt it might be worked like crop-coal and clay ironstone, as described by Mr. Farey, *i.e.*, merely by sinking pits down to the Coal and raising it at once; and after undermining on all sides as much as can be done safely by the use of props, the latter may be withdrawn, and the roof allowed to fall in.

This Coal burns with a bright flame, and answers admirably for steam purposes; 50 pounds tried in the still furnace laboratory of the Honourable Company's Dispensary, afforded four gallons of distilled water, and left a residue of four pounds weight of ashes, cinders, and small coal that fell through the bars of the furnace during combustion. Its specific gravity is 1.27.

Composition.

Volatile matter and water -	-	-	-	-	-	55
Carbon -	-	-	-	-	-	40
Ash -	-	-	-	-	-	5
						100

It is to be regretted, however, that the bed seems to contain seams of shale, or that various thin beds of Coal, separated merely by thin beds of shale have been mistaken for one thick bed of Coal, and the mixture of Coal and shale both supplied together. It is necessary on such occasion to recollect that a Coal-field consists not of one, but a series of beds placed one above another; of these, some may consist of good, others of bad Coal, and that it is the best only that should be worked.

The distance of this Coal in a direct line from the coast being only 29 miles, Lieutenant Hutchinson proposed to construct a road, which he supposed would reduce the expense of delivery on the coast considerably. Boats of large draught, it is said, may ascend the Tenasserim river at all seasons to Tenasserim town, within 29 miles of the Coal, and during the rainy season to the Coal itself, so that nothing could be more favourable than the position of this Coal for all purposes of local improvement, as well as for steam navigation to eastward. Forty tons of this Coal cost $5\frac{1}{2}$ annas per maund at Mergui, and 8 annas per maund in Calcutta.

Coal on the Lenhea
river.

We have been informed by Captain Lloyd, *i.n.*, that about one degree lower down the coast, Coal has been found of very good quality, on the Lenhea river; but the Committee have no information on this head, although some progress had been made in raising a quantity when the work was discontinued, in consequence, probably, of the more favourable position of the Coal near Tenasserim. The Lenhea Coal is situated, Captain Lloyd thinks, about $11^{\circ} 22'$ N. lat. and $99^{\circ} 8'$ E. long., about 40 miles up the river, the navigation of which is doubtful. It is, however, the most southern point at which Coal has been hitherto found on the Malay coast.

Coal at Maulmain.

A detached fragment of an inferior Coal, called anthracite by some, has been found near Maulmain, latitude $16^{\circ} 30'$ N., thus indicating the presence of Coal formations between the Tenasserim Coal-fields, 12° N. latitude, and Arracan 19° N. latitude, and holding out strong inducements to further search being instituted in that quarter.

And Tavoy.

More recently, excellent specimens of Coal have been presented to the Committee by Mr. Blundell, the Commissioner of these provinces, as found somewhere on the Tavoy river. On this subject further information may shortly be expected.

BURDWAN AND ADJI COAL DISTRICT.

THE Burdwan Coal District is certainly next in importance to that of Sylhet, that part of it in which the collieries are situated is 140 miles N.W. of Calcutta, and is traversed by two rivers, the Damuda and the Adji; the first enters the Hoogley about 25 miles below Calcutta, and the second enters that branch of the Hoogley called Bhagirutty, about 70 miles above that city. The point at which the Damuda forms a junction with the Hoogley is 160 miles from the site of the Coal mines; whereas Cutwa, the town at which the Adji joins this river, is only 110 miles from the mines, while it is 70 miles nearer the great line of navigation on the Ganges, making a difference of 120 miles in favour of the Adji compared with the Damuda, as a line of conveyance to that part of the Ganges for the navigation of which the provision of Coal is now chiefly required to be made. As a drawback, however, from this very marked advantage, there would be a land carriage of ten miles across the country, from the present mines on the Damuda to the Adji; but as these rivers extend parallel to each other for the distance of 40 miles (according to Arrowsmith's map), the most favourable portion of this space might be selected for the construction of a railroad from the present mines on the Damuda to boats on the Adji.

Burdwan and Adji
Coal District,
1837.

The advantage of the Adji compared with the Damuda as a line of conveyance, has here only been considered with reference to Coal already worked; but the assistance which the Committee is receiving from the communications of Captain Forbes with Mr. Erskine, a gentleman residing on the spot, leaves scarcely a doubt as to the existence of good workable Coal close to the Adji itself; and in a letter received from Mr. E., dated 6th July 1837, four situations are pointed out in which good Coal may be raised, and delivered into boats at an expense of from $\frac{1}{4}$ to $\frac{1}{2}$ an anna per maund. He moreover announces the dispatch of 2,000 maunds which will be delivered at Cutwa, at the rate of 3 annas per maund, including all contingent charges.*

The first situation in which Mr. Erskine points out Coal, is Mammudpore, two coss south of the Adji Ghat, at Seedpore, land carriage per maund $\frac{3}{4}$ ths of an anna, but this Coal, as it appears on the surface of a ravine in which there is a stream of water, is somewhat heavy and hard. The quality may probably improve by pursuing the vein to a distance from the surface, or by sinking a shaft, better beds may be reached.

Mammudpore
Coal.

The second locality pointed out by Mr. Erskine, is a little to the west of the first, and $2\frac{1}{2}$ coss from the same ghat, carriage per maund $\frac{3}{4}$ of an anna, quality better than that of the first.

The third place, and that from which Mr. Erskine himself has been in the habit of taking Coal, is Pariharpore, a good deal west of the other situations, and only two coss, Mr. Erskine thinks, from the Damuda, and four coss in a south-westerly direction from Durbadanga, the nearest ghat on the Adji, which is one coss above Seedpore,—carriage $1\frac{1}{2}$ per maund. This is a lighter and more brittle Coal than either of the others, presenting a glistening and resinous lustre, and on exposure is inclined to crumble. Mr. Erskine is also kind enough to say, that he will take an early opportunity of visiting the several situations in which the above-mentioned Coals occur, and will afford the Committee farther information as to the nature and extent of the several beds.

Pariharpore Coal.

Mr. E. says that to the eastward of Mammudpore, all traces of Coal, or indeed any rocks, disappear, while on the contrary the quality of the mineral improves on advancing towards the west. Mr. Erskine adds, that the last time the late Mr. Jones visited Elambazar, he said that in his borings about Beerkoolthee, near the Seedpore and Durbadanga Ghats on the Adji, he had met with Coal even superior to that on the Damuda, and wished much to open a mine in that situation, in conjunction with the late Mr. D. Erskine.

Upon

* In a subsequent letter Mr. Erskine states that he had raised 4,000 maunds, and that the additional 2,000 maunds were also dispatched, but that he feared the expense would be four annas per maund, which is, however, only half the present contract price. For this important result the public are entirely indebted to Captain Forbes and Mr. Erskine.

The Coal thus delivered was at the time thought unfit for use on board steam vessels. Nevertheless, three years afterwards, when it became necessary to inquire what had become of the 4,000 maunds of Coal, it was found to have been all delivered to the steamers and used by *mistake* as Burdwan Coal. See Proc. Com. April 1841, para. 3.

Burdwan and Adj
Coal District,
1837.

Upon the whole, the Burdwan Coal-fields appear to be as yet very imperfectly known; from 1817, the date of Mr. Jones's last communication (published in the "Asiatic Researches," in 1829) until the present time, no communication has been made from this quarter except the interesting remarks of Mr. Erskine just quoted. Mr. Jones, about the same period, reported the discovery of the south-east basset of this Coal, about six miles from the place then established as a Colliery, so that he was induced to believe from this circumstance, that a basin of great extent, containing many beds of Coal, exists; Colonel Shelton has recently found a rich vein of Coal crossing the Benares road at Angballee, close to the 187th milestone, which rather tends to support Mr. Jones's conjecture. It is, however, the eastern and the northern limits of the Burdwan Coal district that ought to be traced with the utmost care, these being the directions in which Coal would be most desirable for purposes of navigation.

As this is a question of much importance, it is necessary to examine the opinions of Mr. Jones regarding it; we cannot attach much weight to an assertion contained in one of his earlier reports, viz., that he did not think it necessary to prosecute his inquiries beyond the point at which the Damuda becomes unnavigable, knowing that the whole country from Jenal to within five miles of Serampore, affords Coal. In proof of which he gave the following section as the result of repeated borings, but does not mention any one of the particular localities in which they were conducted. Common clay, six feet; loose sand, one foot; slate, seven feet, with four inch layers of sandstone, 12 inches apart, containing impressions of plants; Coal and slate, nine feet; black slate; two feet, bad Coal not cut, three feet, = 23 feet.

Still less can we coincide with the soundness of his reason for supposing the great line of navigation to be intersected by Coal beds somewhere about the situation of Cutwa, where he consequently thought Coal might be found merely because he supposed that direction to be indicated as the course of the strata in the mines of Ranygunge. The importance of the subject, however, and the extent of Mr. Jones's local knowledge, would justify a few borings being resorted to, at certain points between Hoogley and Rajmal.

It is to be regretted that the official authorities in Burdwan, and Mr. Jones's successors in the management of the mines in particular, should have profited so little as they appear to have done by his example, and that even occasional notices of the progress of the works he established, should since his time have been discontinued. The depth of the shafts, the direction of the galleries, and the nature of the beds through which they are excavated, would be information of the highest interest, and well calculated to bring into notice whoever might furnish such details. The practical reports of miners have at all times been received as the most valuable contributions to science, and are justly looked upon as the most estimable records of a class of facts which are second to none in importance.

The face of the country composing the Burdwan Coal Districts is described by Mr. Jones as undulating, presenting a difference of level between the heights and vallies of about 60 feet. The surface is composed of a yellow clay supporting a good soil, both slightly calcareous. The clay rests on a grey sandstone that effervesces in acids, and which is seven feet in thickness; in many places where its surface is exposed, a slight efflorescence of soda is found on it.

Beneath this rock an inferior quality of Coal, accompanied with shale, containing the impressions of plants, occurs bending over the low hills and descending deep beneath the surface of the vallies. Below these beds good Coals are found. Though wheeling in a slight degree, the bed of Coal carry their line of bearing to an amazing extent (says Mr. Jones) with little variation; their breadth in a south-west direction may be supposed to extend 11 or 12 miles towards Bancoora, where hornblende, sienite, and quartz, begin to appear. In a north-west direction the attendants on coal are traced for seven miles from the present works along the right bank of the Baracan river to a place called Rajkol, and in this course the Coal Measures are intersected by a large windyke running in the direction of Bishenpur.*

The first bed of Coal is reached in the Ranygunge Colliery at a depth of 45 feet 3 inches, and is 1 foot 3 inches in thickness, and of inferior quality, succeeded by alternate layers of Coal and shale for a further depth of 3 feet 9 inches, including two thin layers of Coal. Two important beds then occur, the first 8 feet

and

* Asiatic Res., 1829, p. 164.

and the other nine, separated from each other by a thin stratum of shale. The lowest of these, which is very good Coal, is separated by a thin layer of sandstone containing vegetable impressions,—from the sixth bed of which is only nine inches, a similar alternation introduces the seventh and lowest bed of good Coal, only three feet below which, 13 beds of sandstone and shale occur, containing vegetable impressions and including a thin bed of inferior Coal. At the depth of 88 feet 2 inches the excavation was terminated in a bed of grey-coloured hard sandstone.*

Burdwan and Adj
Coal District,
1837.

This description refers to the mines in 1815, scarcely more than a year after they were first opened, since which time nothing has been communicated on the subject, but it is probable the workings have been since carried on in the nine feet bed, 57 feet from the surface, and that no greater depth than 88 feet has been attained.

The whole district affords rich and valuable iron ores of various kinds, and Mr. Jones, after erecting temporary furnaces and forges at Sheargur, found by many experiments that immense quantities of iron can be made at little expense, but he recommends works of this kind to be conducted on a large scale by means of mills. Clay ironstone, red and brown ironstones of a poor description, as far as they have yet been tried, are common throughout this great Coal district.

Since our last report little has been elicited regarding the northern boundary of the Burdwan Coal-field, where the beds advance towards the Adj river. Mr. Erskine in reply to a circular from the Committee, dated October 1838, recapitulates the different places at which Coal has been found. Mammudpore is the most eastern situation. The pits are here four or five miles from Seedporeghat. The mineral is better to the westward at Pariharpore, about 10 or 12 miles above Seedpore. Seedpore is 18 miles from Cutwa or Culna on the Hoogley, and the river is pretty open during the rains for boats of 400 maunds burden from Maully Ghat to Cutwa, a distance of 40 miles. The upper portion of the river rises and falls suddenly, so as to render it difficult to manage a larger boat than 200 maunds. Mr. Erskine observes, that considering the difficulty of the Adj navigation, and the scarcity of boats at present, and also the high price that it would be necessary to offer to boatmen to induce them at first to undertake the carriage of Coals; he does not think the Coal could be delivered at Cutwa under four annas per maund. Should the regularity of the employment induce people to build more boats (as has been the case on the Damuda) prices might fall to about three annas per maund. Adj Coals are now used for the Dhoba sugar works, to the extent of 10 or 15,000 maunds per annum.

1840.
Adj Coal.

Mr. Erskine has recently renewed his offers to supply Coal at Cutwa, but the price at which he would undertake the delivery of a limited quantity, not exceeding 10,000 maunds, is six annas per maund. (*Vide* Proceedings March 1841, para. 11.) The quality of the Coal Mr. E. proposes to supply at this rate appears to be good. In a memorandum dated 10th May 1841, Captain Johnston reports of Mr. Erskine's Coal that small sample sent for trial consisted of large blocks from 50 to 60 lbs. each kept up steam well.

1841. Adj Coal.

SYLHET COAL DISTRICT.

THE existence of Coal at Burdwan has been known as early as 1804, when it was observed by the officers of a regiment marching across the district. This discovery was communicated to the late Major General Hardwicke, and although the country was at the time depending for supplies of Coal on England and New Holland, no farther attention appears to have been directed to the subject until 1809, when the military board, having been called upon for information, appears to have reported unfavourably of the quality of the coal in question.

In 1813, when the inconvenience of depending on distant sources for an article of such increasing consumption began to be felt, Mr. Colebrooke directed the attention of Government to a discovery of Coal that has been made near Sylhet by Mr. Stark, but which coal was shortly afterwards also condemned by the officers

Sylhet Coal
District, 1837.

* See Asiatic Res., 1820, p. 167.

Sylhet Coal
District, 1837.

officers who were directed by the military board to report as to its quality. Mr. Jones was then dispatched by Government to examine the Burdwan Coal on the spot, and to report the best way of rendering it available to the public works in Calcutta, but the difficulties attending the navigation of the Damuda river near the source of which the Coal-field is situated, induced him to look with more confidence of success to the Sylhet Coal district which he was accordingly permitted to visit.

Mr. Jones reported from this quarter that Coal-tar, beads, and amulets, had been manufactured for centuries about the neighbourhood of Laour, from Coal found in the Kasya Mountains, but the impracticable nature of the country and the rude condition of the Kasya tribes, prevented his making any considerable progress in discovery; and it was not until after these mountains became subject to the protection of the British Government that an extensive bed of Coal, forming a large portion of a precipice, scarcely more than a mile from Cherra Ponji, was brought to public notice*

This Coal may at any time be delivered into boats at the foot of the mountains at four annas per maund, this being the regular rate of porter hire, and from the way in which the Coal occurs at Cherra, no expense is incurred in extracting it.†

If the demand for this Coal were sufficient, the expense of conveyance might be much lessened by carting it from the pit to the brow of the mountain, and for the remainder of the distance by employing either mules or bullocks, except at the more difficult passes, where men might be stationed to receive the loads; such improvements in the mode of conveyance would imply a certain outlay in forming better roads, but even without this, Mr. G. Loch has afforded a practical proof of its value by the delivery of 1,000 maunds of this Coal at Dinapoor, including all charge, and under every existing disadvantage, for 425 rupees, being 350 rupees less than the contract price for Burdwan Coal, an inferior article. It is possible, however, that contractors may not be found ready under the present limited demand, to supply this Coal at so great a reduction, and perhaps Mr. Loch's experiment will require to be repeated before the result can be considered as the scale at which the Cherra Coal may be made generally available on the Ganges. It is, however, to be observed that two-thirds of the expense incurred by Mr. Loch was for mere conveyance from Cherra to the foot of the mountains.

Indications of Coal
at the foot of the
Kasya Hills.

No attempts have been recently made to find workable beds of Coal nearer the foot of these mountains, although several highly favourable indications have been observed in various situations between the Patli river and Sylhet, both by Mr. Stark and Mr. Jones. Even the bed from which the first boat load of Coal sent from this quarter to Calcutta for trial, although situated near the foot of the mountains, and four feet in thickness, is now little known.

About two miles from the mouth of a small river which descends from the lower Tippera Hills, petroleum issues from a sandstone near the bed of the stream. Mr. Jones sank to the depth of four feet into the rock, when he found it become slaty, thus indicating he says, the presence of Coal, though it does not appear why he did not persevere in his excavation. He observes, however, that as the place is well known, others can, if necessary, prosecute the search.‡

In the Patli river Coal is plentifully found in rolled pieces, supposed to be derived from several sources—some of the streams which enter the Patli, from the Garrow Mountains, introduce abundant fragments; some of these are also supplied from sources much nearer.

The plains near Susung, and beyond Seripore or Cheripore, is a small rivulet, in which there is a nine-inch vein of Coal. On the top of what Mr. Jones called the second range of mountains in Laour, but which may rather be supposed to be little more than one of the higher ranges of hills at the base of the Kasya Mountains, the people who accompanied Messrs. Jones and Stark found a two-foot bed

of

* "Journal of Asiatic Society," 1832, p. 252.

† From May to September small boats can approach the base of the mountains by the Pandua river, at other seasons the ghats are sometimes two, and at others four, miles distant, but no difference of charge is made by the porters on this account. See "Journal Asiatic Society," vol. III., p. 26.

The quality of this Coal is considered by Mr. J. Prinsep as ten per cent. better than that of Burdwan.

‡ There is a small cluster of hills adjoining the place, composed of sandstone, the most remarkable of which is named Arpun, and is well known from a Mussulman Doorga being placed on the top. Opposite to Solagur, in Laour, there is another petroleum spring, the product of which is named Otr, and is used externally in cutaneous affections.

of Coal of good quality, but Mr. Jones was of opinion that no smaller vein than four feet would pay, and the descent, he observes, was difficult.

Sylhet Coal
District, 1837.

In the Disyung river and its tributaries, Mr. Jones states fragments of common Coal are found, but in less quantity than in the rivers about Laour, so much so, that 15 persons were seven days in collecting one maund without finding the source from whence any of the pieces were introduced. It is worthy of remark, that all these indications of Coal are quite independent of the Cherra bed, as no fragments were found in the Pandua river, or in any of the streams which fall from the mountains, on which the Cherra Coal is placed.

In a letter, addressed to W. B. Bayley, Esq., Secretary to Government, dated 24th April, 1815, it is stated by Mr. Jones, with reference to Sylhet Coal, that Mr. Stark had found a vein seven feet six inches in thickness, which dips one inch and a quarter to a foot, thus rendering it easy to work, adding,—“the water will discharge itself, and the road to it will be good.” Mr. Jones tried a basket of this Coal, sent to him for the purpose, and found it of good quality; the locality, however, is not mentioned. In a subsequent letter, dated 15th May, 1815, Mr. Stark himself addressed Government direct on the subject. It would seem from his statement, that the discovery was made in the mountains between Pannatick and Bunsikora, and that 250 maunds taken from two distinct veins has been sent to Calcutta with a proposal to supply the public works to any extent with the same kind at 12 annas per maund. In a more recent letter, dated 10th January, 1816,* Mr. Stark addresses W. H. Trant, Esq., Secretary to Government, and explicitly points out the situation of the two beds of Coal above referred to. One of these was discovered by himself at Charago in March, 1814, and was examined by Mr. Jones the following February, but was abandoned, in consequence of not having water-carriage, it was alleged sufficiently near; Mr. Stark then renewed his inquiry, and found a bed of Coal at Barachara, which would seem to be the one described as seven feet six inches in thickness. Mr. Stark stated that he was happy to find the quality of this Coal improved the deeper the excavations were carried, although what had been taken from the surface had been tried and approved of in Calcutta, so that he was led to expect that this Coal would equal that brought from Europe. Having failed, however, to create a monopoly in his own favour (and by the attempt excited the opposition of Mr. Jones and Messrs. Raitt, Inglis and Co.†), the Barachara and Charagow beds were given up, and finally lost sight of by the success of Mr. Jones's Mines at Burdwan.

Charagow and
Barachara Coal.

There can be little question as to these beds being placed much more favourably with regard to the plains than the Cherra Poonji Coal, for, independent of the remark that “the road to it will be good,” Mr. Jones, as well as Mr. Stark, had too little confidence in the disposition of the Kasya tribes to venture further into their country than the skirts of the hills.

Although the pyrites contained in Charagow and Barachara Coals may render them unfit for fuel, still they may be employed profitably in the manufacture of the sulphate of iron and coal tar. To obtain the first of these articles in large quantity, the brassy or pyritous Coal, as it is called, might be exposed during the rains in a pit calculated to collect a certain portion of water; the sulphur will decompose the water thus accumulated, and form sulphuric acid, which, by acting on the iron of the decomposed pyrites, will form the salt in question, which may be purified by subsequent lixivation and crystallization, which, like the first part of the process, may be performed by the natural changes of season in India. In this way an important article in the arts and commerce of the country

Sulphate of iron,
how it may be made
from refuse Coal.

* This letter is not in possession of the Coal Committee, but may be seen in the reports of the Select Committee of the House of Commons. It casts a complete light on what is stated in paragraph 57, regarding the situation of the beds from which Mr. Stark sent down the first boat load of Coal for trial.

† Mr. Cracroft states, “that Mr. Inglis embarked 5,000 rupees in working this Coal, which was dug close to the water and loaded on the boats at once; but it was not approved of on trial in Calcutta; the money was consequently lost, and the speculation abandoned. The Coal is highly impregnated with pyrites, which renders it unfit for use in steamers.”

But supposing the Coal discovered by Mr. Stark to be that which was afterwards worked by Mr. Inglis and disapproved of, yet still when we recollect that the Burdwan and Palamow Coals were also at first condemned, it would be desirable to know something more regarding the Charagow and Barachara beds and their topography before we again cast them aside.

Sylhet Coal
District, 1837.

country might be obtained almost without labour.* One of the specimens of Coal recently discovered by Lieutenant Vetch on the north side of Assam contains a considerable proportion of pyrites, and would, as well as the Sylhet Coal referred to by Mr. Cracroft in the preceding note, answer admirably for this manufacture.

Iron ore.

The hills in the neighbourhood of Sylhet, Mr. Jones says, afford an iron ore in their concretions resembling cast-iron plates,—what he alludes to is an oxide derived from the loose sandy materials of these hills; but, being spread over a great surface, and occurring in but small quantities in any particular place, it may be considered as of no great importance, but its value will depend in a great measure on the degree of success that may attend inquiries for Coal at the foot of the mountains.

Perhaps it was the presence of this ore that led Mr. Jones to look upon Pandua as the best situation he had seen for the establishment of iron works for the manufacture of bar, bolt, and hoop-iron. The late Colonel Watson also expressed himself favourable to similar views, but seems to have formed them chiefly on the supplies of iron procurable in the interior of the mountains, but this source would also, it is to be feared, be insufficient for the supply of extensive works. The vicinity of Coal, and the convenience of the situation with reference to navigable rivers, certainly render it desirable that such resources in this quarter should be fully investigated.

Iron ore.

The ore now in use in the interior of the Kasya Mountains is procurable with considerable difficulty by washing the sands in low and inconvenient valleys in very remote situations. The method of smelting it, has been briefly noticed by Mr. Cracroft, but a few additional particulars regarding a process so simple as to enable one person with ease to conduct the several occupations of working. The bellows, and supplying ore and fuel at the same time, may here be interesting, particularly as the same operations, as they are performed in Kemaon, require two persons for the bellows alone, and so laborious is this part of the labour, and so much exposed to heat and smoke are those engaged in it, that they are obliged to be relieved every ten or fifteen minutes.

Manufacture of
iron.

Over the fire (in the Kasya method) is placed a hollow cone made of clay, and open at both ends, the object of which is to prevent the radiation and consequent loss of heat so inconvenient and disadvantageous in the Kemaon method. The mixture of ore and wet charcoal in the proportion of two parts by weight of the former to one of the latter, is held in a trough at the top of the cone. The bellows are placed vertically at some distance from the fire, with which they communicate by means of a horizontal pipe. The individual by whom the several occupations already mentioned are conducted places himself on the end of the bellows, with a foot on each valve (*see* Mr. Cracroft's Figure, plate 6, Vol. I. "Prinsep's Journal"), and, by changing the weight of his body from side to side by an alternate rocking motion, and at the same time balancing himself as well as the bellows by means of a rope fixed below to the latter, and above to the roof, and held in one hand, while with the other, by means of a long shovel, he supplies the mixture of fuel and ore from the trough, but in small quantities at a time, not unlike the way in which grain is supplied from the hopper of a mill. The large quantity which is thus kept in fusion compared with the small proportion in which the ore is supplied, may be supposed to facilitate reduction, and to constitute one of the chief peculiarities of the principles.

Every two hours, or 10 times during the 24, the iron is extracted from the fire in the form of a ball about five pounds weight, which, while hot, is beaten, as described by Mr. Cracroft, with a wooden club into a flat, compact form; it is then split almost in two with a heavy iron cleaver, which renders it more easily converted into bars.

There may be five forges of this kind in the village of Serrareem, each yielding 20lbs. of iron daily, and 100 villages in which the trade is carried on to the same

* Sulphate of iron, or green vitriol is used as a cheap substitute for sulphuric acid in chemical manufactures. There would be a considerable demand for it in the Calcutta market if the price at which it is offered for sale were at all reasonable; but at present the contract price for the little that is indispensable in the laboratory of the Hon. Company's Dispensary is purchased at 10 rupees per maund for the impure sulphate, which we have no hesitation in saying might be produced at a tenth of that sum. The demand for green vitriol at a reasonable price, would be very considerable, and its production at a cheap rate a great boon to the manufacturing chemist.

Sylhet Coal
District, 1837.

same extent. Suppose the smelting to be continued only during the cold season, 1,650 tons of iron would be annually produced. Mr. Jones states that the iron from the mountains sold in his time (1815) at the foot of the hills for *R.* 1. 5. per maund; but, according to inquiries in Serrareem, as well as at one of the weekly markets at Myrung, where several tons of iron were exposed for sale, the price on the spot was from 14 annas to a rupee for 20 seers, or, at the lowest, *R.* 1. 12. per maund; which, compared with the price stated by Mr. Jones, would make a material difference, not merely in the aggregate value of the trade, but also in the profits that would result to those who might embark in such works as those recommended by Mr. Jones. Still, however, the price above stated is from 14 to 26 annas per cwt. less than the average price of English pig-iron in Calcutta during 1835, so that if it could be delivered in sufficient quantity at such rate, the manufacture might be successful; the reduction of the ores found in the plains along the foot of the mountains, might, however, make up for any deficiencies from above, and thus in the vicinity of Coal, sufficient supplies of iron for works of any extent might be obtained.

The mountain ore produces about 50 per cent. of iron, and unlike that of the Ponar valley in Kemaon, it is only necessary to submit it once to the fire. A great bed of Coal forms the surface on which the village of Serrareem is erected, but unless some more profitable and convenient repositories of the ore can be found than those already employed, the use of this Coal as a fuel would be of little advantage; the smelting as it is at present managed, is far from being the most expensive part of the manufacture.

From the indications afforded by the north-east frontier, if we include under this head the Coal Districts of Sylhet, Cherra, Arracan, and various parts of Assam in which Coals have been noticed, we may safely calculate on their affording supplies not merely for the navigation of the Bramaputra to its source, but also for that of the lower parts of the Ganges as well as the adjacent parts of the Bay of Bengal.

We learn from Captain Jenkins that the late Mr. Scott was aware of the existence of Coal somewhere in the vicinity of the Caribari hills, and the committee have recently been put in possession of the fact referred to, by the existence of two beds of good Coal being detected at Doorgapore in the Garrow Hills; but particulars as to the extent of the beds and the circumstances under which they occur are yet insufficiently known, so that we cannot at present venture to offer any further observations on the subject, than merely to say, that we are in daily expectation of more information from this quarter.

Doorgapore Coal.

Although the attention of the Coal Committee has been constantly directed to this quarter, the only result accomplished since the last Report, that can be said to be new, is the delivery of 10,000 maunds of Cherra Coal at Goalparah, in Assam, at the rate of eight annas per maund, after the attempt to supply that station from Burdwan had failed.

Sylhet, 1840.

Three beds of Coal, situated near the foot of the hills, have been brought to notice, but we have no information on the subject to enable us to decide whether these are new discoveries, or merely the bed alluded to in our last Reports as having been brought to notice some 25 years ago by Messrs. Jones and Stark. Without going into that question, we shall merely state all we know of the three beds now alluded to:—

The first and most promising is that of Byrung Peonji, situated near a village of that name, within about two miles of water carriage, and the ground such as to allow of the construction of a hackery road.

Byrung Peonji
Coal.

We know nothing of the circumstances of the bed further than is stated by Mr. Landers, a practical gentleman, who has been appointed to the superintendence of Coal Mines in Sylhet and Assam, and who observes:—

“Byrung Coal is of a soft quality, intermixed with stones, three feet and a half high and varying in its thickness. The vein runs from east to west, and descends with the hill towards the south: to what extent this field may exist, it is impossible at present to say, the want of proper implements” (these have been since provided) “prevented me from ascertaining; a trial ought to be made by running galleries into the strata six or eight fathoms, at once to determine both height and quality, and also if it would admit of any outlay.” This Coal has been tried, and appears to be likely to answer very well

Sylhet Coal
District, 1840.

Chiela Coal.

Mustuck Coal.

for steam, while it has the additional advantage of yielding excellent Coke.*

Not far distant from the Byrung bed, there is another at a place called Chiela or Chaila, which varies from one to three feet in thickness. This, however, is said to be an inferior Coal.

Major Lister, to whom we are indebted for the first and almost the only information we had regarding the two foregoing Coals, states, that Mr. Inglis of Chuttack, has found a Coal bed above Chaila, at a village called Mustuck, about 1,500 or 2,000 feet above the plains, and within such distance of water-carriage, as to enable a porter to deliver five burdens daily from the pit into boats. Mr. Inglis is of opinion, that this Coal is quite as good as that of Cherra, and Major Lister observes, that it looks so, though the quality is different, being blacker, with an exceedingly high polish; it burns considerably longer than Cherra Coal, and cakes less, but is heavier, and yields more ashes.

The value of these, as well as similar indications alluded to in our Report for 1838 is still doubtful, and must remain so until the whole tract along the base of the Kasya hills be submitted to a geological survey. For the present season, if the Government require Coal from this quarter, we agree with Major Lister in thinking it will be necessary to confine our exertions exclusively to the Cherra bed. This, as is well-known, is situated on the summit of a mountain, nearly 5,000 feet above the sea, and at such a distance from navigable rivers as to render it a day's work for each cooly to deliver a maund, or about 80 lbs., of Coal from the pit into a boat.

The only way of lessening this inconvenience would be by improving the conveyance, by an improvement of the road. Above and below the steepest portion of the descent would admit of bullocks being used, as stated in p. 48, in our former Report. Instead of porters for the steeper or middle portion of the journey, it has been proposed to construct a slide, as suggested by the late Colonel Watson. The improvement of the road between Cherra and the plains would be a work of some public utility, as it would be the means of facilitating ingress and egress to and from the mountain plateau, it would, therefore, be a very desirable object, independent of the Coal. The value of a slide, however, would depend entirely on our success in finding as good a Coal below, as that which is above, an uncertainty which can only be removed by a perfect geological survey, as already suggested.

Some difference of opinion prevails as to the best way of transmitting Sylhet Coal to the great lines of inland navigation on the Ganges: some contending that it would be necessary in the first instance to send them a distance of 300 miles to Calcutta, and from thence back to Surda, and other depôts on the Ganges; experience is the only way of settling questions of this nature, and measures are now in progress for the delivery of the largest possible quantity 10 or 15,000 maunds of Cherra Poonji Coal in Calcutta, with the least possible delay, compatible with the fair trial of the experiment.† The Kasyas, on whom the burden of the experiment will literally fall, though a fine athletic race, are little accustomed to labour; Major Lister may, therefore, have some difficulty at first, in reconciling a sufficient number of them to a continued effort, the object and importance of which they can be so little expected to understand.

Quality of Cherra
Coal.

It is necessary to take the quality of Coal into account before any particular price per maund can be regarded as dear or cheap; it is quite incredible to what degree a slight difference in quality affects the value of Coal for steam-vessels. It has been found by means of the only trial instituted between Cherra and other Coals now in use, that nine maunds are equal to 14 of Burdwan Coal. Let us suppose (without laying too much stress on a single trial of a few maunds) the proportionate value of the two Coals to be ascertained as above; 100 maunds of Cherra would not only as a fuel be equal to 155.5 of Burdwan, but we should also have to debit to the latter the value of 55.5 maunds stowage or tonnage, which might amount to more than the entire value of the Coal consumed.

The Cherra Poonji Coal forms the cap of a hill from which each cooly may help himself to his load, almost without the aid of mining, so that the carriage,
four

* Communication has been received from Major Lister since the above remarks were written stating that Mr. Landers has tracted the Byrung Poonji bed for two miles to the westward, without finding more on an average than a foot of good coal.

† This was accomplished during the rainy season of 1840 by Major Lister, who delivered 21,000 maunds of this Coal in Calcutta at nine annas per maund.

Sylhet Coal
District, 1840.

four annas per maund from the pit to the nearest navigable river, though high, may be said to include the expense of winning, or bringing Coal to the surface. Could any of the following indications of Coal lower down towards the foot of the mountain, be found to yield good supplies, a portion, or nearly the whole of this large item of expense might be saved, viz.: 1. Tipperah Hills, in a small river which descends from a hill with a Mussulman Doorga called Orpeen, on its summit. 2. Opposite to Jalalgur, in Laur. 3. Patli river and several streams descending from the Garrow Mountains. 4. Near Susung. 5. On the top of one of the lower ranges at Laour, and in the rivers of Laour. 6. In the Dysung and its tributaries. 7. Between Pannalik and Bansekora. 8. Barachara, to which we have now added Byrung, Poonji, Chaila, and Mustuck. (*Vide* proceedings.)

The rate of boat-hire from the Sylhet District, along the verge of which the Coal formation lies, to Surdah on the Ganges, one of the principal depôts for the supply of steamers, is stated by Mr. H. Inglis to be 21 rupees per 100 maunds. In regard to water conveyance, Sylhet has the advantage of any of the Coal districts to the westward, while its proximity to the great rivers of Bengal gives it an advantage over the Assam Coal Districts; and thus while any mines that might be established in Sylhet would hardly be affected in value by similar establishments in any other part of India, there is hardly a district from Arracan to Palamow the value of whose mines would not seriously be affected by any subsequent discovery of Coal in Sylhet. In like manner any Collieries that might be established in Assam, or other remote provinces, would be entirely superseded in the Bengal market by any new discoveries of good beds of Coal that might be made in the Sylhet District. It is for this reason that we have suggested the importance of a scientific investigation of the Coal measures along the base of the Kasya and Garrow Hills, since upon this, and the manner in which it is conducted, must depend in some measure the prudence of investing capital in more distant Coal districts.

Advantageous position of the Kasya and Garrow Hills, for Coal Mines near their foot.

Surdah is within a few miles, of Bogwangola, a principal mart for grain of every kind, goor, oil, ghee, and the chief articles of Native consumption. Being situated in the centre of Bengal, near the junction of all the principal rivers, as the Bhaugarutty, the Ganges, and Bramaputra, it is naturally the centre of internal commerce, and consequently the greatest mart for boats in Bengal. Surdah, or some situation in that neighbourhood, appears therefore to be a desirable situation for a general depôt, and as this point is of importance, we have consulted J. W. Grant, Esq., of the Civil Service, who had been long Commercial Resident at Maldah, and Major Carter, who has been for a large portion of his life in the Bengal Commissariat, and the experience of both these gentlemen goes to prove that at Bogwangola and Jellinghee, boats for the transmission of Coal from Surdah to any part of Bengal, or the Upper Provinces, may be had to any amount of tonnage likely to be required.*

The distance from Cherra Poonji to Calcutta by water, is about the same as to Surdah; while the latter is 150 miles nearer to Rajmehal, and other depôts to the eastward.

Major Carter states that the voyage from Calcutta to Cherra in an empty boat should not take above 24 days, and returning laden, about the same period, as the stream would be favourable to Dacca, and from thence in the tideway. "Assuming, however, two months as the time necessary to complete a voyage, including loading and unloading, it strikes me," says Major Carter, "2½ annas per maund should nearly cover the carriage, and below I give the grounds of my opinion,

	Rs.
A 1,000-maund boat can be hired at per mensem	- 30
10 Dandies at 3 rupees each	- - - 30
1 Manjie at 4 rupees	- - - 4
	64
	2
	Rs. 128

Rate of boat hire
from Sylhet.

This

* We have been the more particular in our information on this point, since it has been suggested that Cherra Coal should first be brought to Calcutta, and from thence transmitted to the depôts on the Ganges.

Sylhet Coal
District, 1840.

This boat should carry 800 maunds, which just gives 2 annas $6\frac{1}{2}$ pice per maund, so that at this rate Cherra Coal ought to be delivered in Calcutta at 7 annas per maund; Major Carter therefore expresses his surprise that an offer recently made by the Marine Board, of 9 annas for Cherra Coal, had not been taken up, and suggests that if boats of 2 or 3,000 maunds, such as are used for bringing wood from the Sunderbunds, were employed as far as the rivers would admit, the carriage would be still lower.

The readiness with which boats may be had for any regular trade, may be imagined by the following observation of Major Carter:—"Hundreds of large boats frequent the Sunderbunds, nearly as far as Dacca, in search of cargoes of rice and dhan, the worth of the former of which is very little more in ordinary years than Coal, and the latter scarcely one-half as valuable; they do not find their cargoes at one place, or belonging to one person, but attend the banks and purchase in whatever quantities the people bring to the market, often only a few seers, and seldom exceeding a few maunds."

The Commissariat regulations and general custom of paying boat-hire on a computed distance, instead of the time actually employed, might in the first instance militate against the economy of any arrangement for hiring boats, says Major Carter; but if a few boats were purchased or built at Dacca, or in the Sunderbunds, and manned by a private individual, the result would prove the correctness of these calculations. A good boat could be built for 500 rupees; and in six trips, at the above rate, would yield 300 rupees, leaving 60 rupees for casual repairs, this would repay itself in less than two years; but a boat is expected to last seven or eight.

CUTTACK.

Cuttack, 1840.

ABOUT ten years ago a specimen of Coal found in the Cuttack District was sent to the Asiatic Society, probably with some particulars, which do not appear to have been noted in the proceedings; the circumstance was, however, suggested to the Committee by Captain Jenkins, in 1837, about which time Lieutenant Kittoe, then with his regiment at Cuttack, obtained a specimen, together with some particulars, which he communicated to the Committee, on which he was requested to visit the spot, where he collected the following particulars. Half a mile from the Fort of Talcheer,* Coal seams are exposed along the banks of a small nullah called Belajoore (at a spot where workmen employed by Mr. G. Becher, had, a few years before, extracted some specimens of Coal). Mr. Kittoe found, in an excavation formed for the purpose, at a depth of 13 feet, a bed of "good glistening Coal," 1 foot to $1\frac{1}{2}$ foot thick, reposing beneath 10 feet of "shingle," and two beds of shale and blue clay, each $1\frac{1}{2}$ foot thick. The latter, as well as a grey rock beneath the Coal, both containing fossil plants.

Mr. Kittoe states, that a native contractor offered, in the event of Coal being raised at Talcheer, to convey it down the Bramenee river to Hunsua, on the coast, where large sloops may anchor, at 4 annas per maund; but Mr. Beetson, the contractor for the transport of salt from thence to Calcutta, was of opinion that 2 annas per maund, at the utmost, would be sufficient. From the coast to Calcutta the transport of Coal would be the same as that of salt.†

The next Coal, to which Mr. Kittoe was conducted by his guide, is a few miles higher up the Bramenee, and at a distance of 16 or 18 miles from that stream, so that its conveyance would be considerably more expensive. The Coal here presents an average height of 15 feet above the sand for a mile on either side of a nullah called Sungurra, a tributary of the Bramenee. The country is said to be level from the Coal to the bank of the Bramenee, so as to afford every facility for the construction of either a road or a canal. Iron ore is found in great abundance throughout both of these Coal districts, and the ore is smelted to

* Talcheer is a town on the Bramenee River, 140 miles from the coast.

† At present there are three contracts of the conveyance of salt from Hunsua to Calcutta: the rates are 18 rupees, Rs. 17. 8. and 17 rupees per 100 maund.

to some extent, and by the same process as that which prevails in other parts of India.

Cuttack, 1840.

Such is the substance of Mr. Kittoe's report.* The specimens of Coal furnished were not of good quality. Three specimens of Talcheer Coal examined at the Mint afforded the following average results:—

Specific gravity, 1·3610.				
Volatile matter -	-	-	-	39·
Carbon -	-	-	-	44·1
Earthy matter -	-	-	-	15·10
				100

Talcheer and Hingolee may be regarded, we think, without much doubt, as an extensive and valuable Coal-field. The workable beds will probably be found to be some distance from the surface at the spots visited by Mr. Kittoe, but the district appears to have been subject to so much local disturbance, that more favourable positions for Coal mines may be expected, when the country has been properly examined.

Since the above remarks were written, the Committee have received a communication from Mr. Mills, the Commissioner of Cuttack, enclosing a report from Mr. Beetson, whom he deputed on 22d February last, at the instigation of Mr. Smith, the President of the Coal Committee, in order to procure further information on the subject. Mr. Beetson reports, that "the samples laid before the Committee, by Lieutenant Kittoe, were far inferior to those I have now brought with me. The latter are equal to the best Burdwan; but to satisfy the Committee as to its description and quality, if Government will pay the expenses, which will amount to a mere trifle, I shall be happy to undertake the delivery of 100 or 200 maunds in Calcutta by next December." Mr. Mills observes that the specimens, as far as he and other gentlemen at the station are able to judge, are so very good, that he authorised Mr. Beetson to procure 100 maunds for trial in Calcutta; 150 maunds were accordingly transmitted to the Committee, in February 1841, and proved to be most inferior description of crop Coal intermixed with Coal shale (*see* proceedings of the Committee, May 1841). There can be no doubt, however, that with a moderate degree of intelligence, as good Coal may be found at Cuttack as anywhere else. The locality in which the Coal occurs is, according to Mr. Beetson, called Gopal Pushad, and the nullah by which it is laid bare, Sangra, which corresponds with Mr Kittoe's name Sangurra. Mr. Beetson states, that the distance from Gopal Pushad to Talcheergur is from 14 to 16 miles, and recommends that the Coal be carted by buffaloes (the common draught cattle of the country) to Talcheergur. From Talcheer, the Coal could then be conveyed in 10 or 12-maunds boats to Kumalung, six miles below Talcheergur, where it should remain till the setting in of the rains, and from thence it may be conveyed for six months of the year in from 100 to 300-maunds boats to Hunsua on the coast, where it would be available for sea-going steamers at from 3 to 4 annas per maund. From Hunsua, Mr. Beetson would undertake to convey the Coal to Calcutta at 18 rupees per 100 maunds; and, indeed, he thinks he could supply it to the Calcutta market at 6 annas per maund, including every expense.

Cuttack Coal, 1841.

RAJMEHAL.

At Rajmehal Coal has been found by Captain Tanner in two situations, viz. at Sierigully, on the banks of the Ganges, and at Hurrah, twenty-five miles distant. With regard to Sierigully this place has been recently visited by Lieut. Don, who reports to the Committee, that as far as he and Lieutenant Egerton, who accompanied him, could determine, no Coal exists at the foot of the Mootee Jarma waterfall, where it was supposed to have been observed by Captain Tanner.†

Rajmehal, 1838.

Sierigully Coal.

At

* *Vide* "Asiatic Journal" of 1839, p. 137, 144.

† I am informed by Mr. C. Glas that there is a Coal Mine at Sierigully, but not at the foot of the waterfall; the spot visited by Lieutenant Don, but near the village of Moharajpore, in the vicinity of the waterfall Moo tee Jarma.

Rajmehal, 1838.

At Hurrah large quantities of Coal have been extracted, but although we have every information relative to the working and expense of conveying this Coal to the river, yet our knowledge regarding the natural circumstances under which it occurs is very defective. This Coal is inferior, and without a more comprehensive knowledge of the district than we are possessed of at present, it is impossible to come to any conclusion as to whether or not better beds of Coal might be expected, and what measures would be most likely to be adopted with success.* Captain Forbes found by various experiments conducted at the Calcutta Mint on 500 maunds of the Hurrah Coal, that nearly double the quantity compared with the Burdwan Coal, was required to produce the same quantity of steam, and that it is generally unfit for smithery purposes; affording an inadequate heat for welding, or even for hammering with facility, and on analysis Mr. Prinsep found it yield upwards of a fourth part in ashes.

Hurrah Coal.

Mr. C. Glas, an old and intelligent resident at Boglepore, says that two and a half miles south of Sercunda and 14 miles from Rajmehal, iron ore is found in the greatest abundance scattered over the surface in masses each several yards square, which might be manufactured to any extent at a trifling expense, but the quality of the iron afforded is inferior to that of English cold short iron; but he says that an ore affording a remarkably superior iron, from which he himself manufactured steel, is to be had plentifully at Misadhe and Joypore, about 70 miles south and south-west of Boglepore. The roads to the part of the district in which this ore occurs are such as to admit of the employment of wheeled carriages for its conveyance to the river side.

Iron ore.

The late Mr. Jones, in one of his letters, observes that, in the neighbourhood of Luchmepore, in the Boglepore Zillah, lead is afforded. In another letter he states that the Hills of Curruckpore, distant 40 miles from Boglepore, are composed of quartz, and contain a rich vein of Galena discovered by Buchanan. Perhaps the same vein is in both cases referred to. "Very probably," he adds "copper will be found in Dholboom near Ragduha,† on a nullah, called Guree, that empties itself into the Subbon Reeka river."

Galena and copper.

Near Sahibgunge Mr. Glas states, alum is found in such abundance as to supply the local consumption of the neighbourhood, but no trouble has been taken to procure it in a better state than that in which it appears on the surface.

Alum.

When our last reports were written, Coal was known to exist in two situations only in the Rajmehal Hills, namely, Sicrigully and Hurrah. In April 1838 Major Forbes was informed by Mr. James Pontet that he had found a bed of Coal in the Rajmehal Hills on the banks of a nulla called the Burmany, 16 miles distant from water carriage during the rains, and about 30 miles west of Moorshedabad, and nearly in the line of the canal proposed by Major Forbes. A specimen of this Coal afforded the following results on analysis:

Doobradgepore Coal.

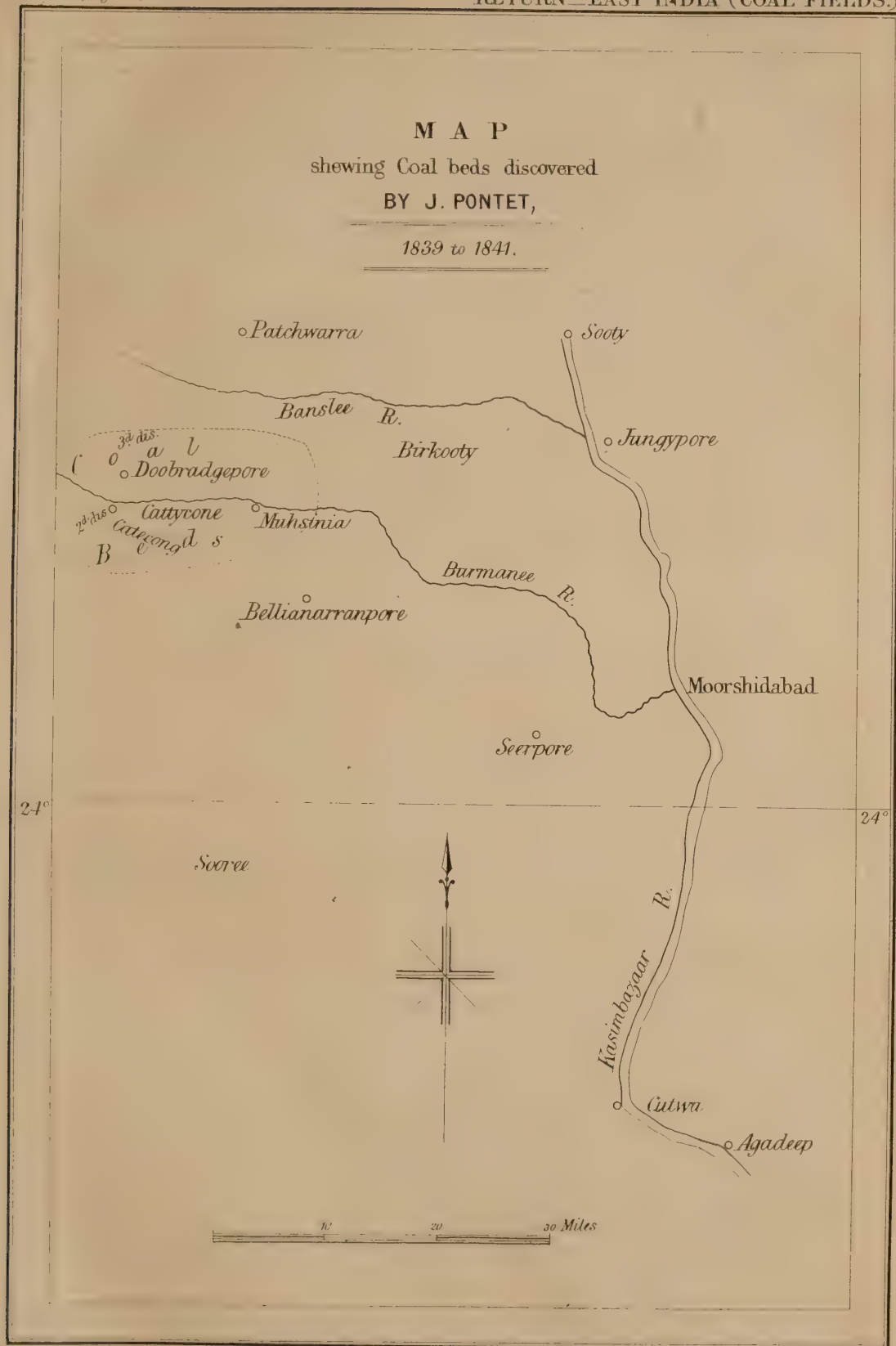
Specific Gravity, 1.370						
Volatile matter	-	-	-	-	-	42.0
Carbon	-	-	-	-	-	44.8
Earthy matter	-	-	-	-	-	13.2
						100

A sample consisting of a few maunds furnished by Mr. Pontet some time before to Mr. Scott the Commander of the Jumna steam-vessel, also proved of favourable quality. Mr. Pontet having been desirous of procuring the means of extending his observation, these were provided, and on the 20th June, he despatched 10 bags of Coal to Calcutta, this also proved favourable; but a subsequent dispatch of 400 maunds consisted of shale and inferior Coal. In explanation of this last unfortunate circumstance, Mr. Pontet stated that the necessary aid did not reach him till the rains set in, when the place being unhealthy, he was obliged to leave the raising and dispatch of the Coal to inexperienced natives.

The following is an extract from Mr. Pontet's letter, in which he describes the operations in which he was engaged. "After the first vein of Coal, we came upon

* Mr. Glas states that Coal is found throughout a large tract of country in Barcoup,—it is probably the same as that discovered by Captain Tanner—a portion of this Coal is said by Mr. Glas to have been recently on fire.

† See Asiat. Res. 1828, p. 170.



upon a hard black stone; and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers and stone-cutters, who have been for the last two months at work, at present to all appearance with satisfactory prospects. As one of the stone-cutters who opened a shaft at Burdwan, says this mine bears some resemblance to it, I am induced to persevere a few feet more, in hopes of coming to a useful vein. The first 23 feet of soil is red and black earth mixed with kunkur, and under that, to a depth of 40 feet, are 13 different strata, three of Coal, and the rest various kinds of stone." Mr. Pontet transmitted to the Committee specimens of all the different beds passed through, which are remarkably characteristic of the true Coal measures; and of 11 different beds passed through in the last 17 feet of the excavation, there were several beds of Coal of good quality, but too thin for working, and in the shale we observed excellent specimens of *Vertabraria Indica*, one of the few abundant fossils of the Burdwan beds that happens to have received a name.

Rajmehal, 1840.

See Proceedings
for April 1841.

The excavation was formed on the N. W. side of the Burmany Nullah; but Mr. Pontet states that he traced the Coal a mile S. W. of the Burmany river, from which he concludes that the Burdwan and Rajmehal beds are connected. Mr. Pontet subsequently found the indications of Coal more extensive than he at first supposed, and that Coal formations extend for 10 miles round the village of Doobradgepore, the Burmany river passing through the centre of the Coal district. While these pages are passing through the press, a sample consisting of 10 bags of this Coal has been received. It presents the appearance of ordinary surface Coal; 40lb. used in one of the furnaces of the Hon. Company's Dispensary, burnt as well as inferior Burdwan Coal, and left 8 lb. of ashes.

The following is the results of analysis of an average specimen of the sample in question:

Specific Gravity, 1.4.							
Volatile matter	-	-	-	-	-	-	42
Carbon	-	-	-	-	-	-	38
Ash	-	-	-	-	-	-	20

							100

In a report on the Rajmehal Canal submitted to the Government in 1832, by Colonel M'Leod and Major Forbes, it is stated that Mr. Ward, the Commissioner of Boglepore, was aware of the existence of Coal in a bed of sandstone near the pass of Patchwary. The situation appears to be 10 or 15 miles to the north of Doobradgepore, and together with the Hurra and Sierigully indications proves the extension of Coal formations along the entire base of the Rajmehal hills.

PALAMOW COAL FIELD.

THE Coal-field of Burdwan is connected by means of what would seem to be the shattered remnants of Coal measures with another principal Coal-field in the valley of Palamow, on the opposite side of the Mongir Mountains.

Palamow Coal-
field, 1837.

Coal has been known to exist in Palamow still earlier than the period at which it is brought to notice at Burdwan, since several spots are marked as Coal mines on Arrowsmith's map, but it was not till after the introduction of steam navigation that the fact excited any interest, when the late Mr. A. Prinsep, then collector of the district, directed attention to its importance; since that period Palamow has been frequently visited by persons sent to inspect the Coal, from whose reports the following particulars are gleaned:—

The Coal-fields of Burdwan and Palamow are separated from each other by the prolongation to the eastward of the Vindhya Chain, to which they bear a similar relative position, both reposing in low hills of sandstone, the one at the southern and the other at the northern foot of the chain.

The valley of Palamow situated at the source of one of the great branches of the Soane, is scarcely raised at its outlet above the general level of the plains of India, but is inclined with a slight ascent to the granitic mountains by which it is sur-

Palamow Coal-
field, 1840.

rounded, except towards the north, at which side the Caile or Palamow river joins the Soane. The length of the valley from north to south may be about 70 miles, but its breadth is much contracted by the approximation of steep granitic hills on opposite sides, between which small diversified vallies are extended laterally.

The climate would seem to be better than that of most parts of India, and if we consider the proximity of the elevated granitic platform on the east and south, a very favourable climate might here be available for the residence of those who would engage in the enterprise of turning the mineral resources of the district to account. The lands being little adapted to the ordinary agricultural pursuits of the country, are in a great measure deserted, but the inhabitants who are peaceable and sufficiently numerous to afford the requisite number of labourers for such works as might here be established, are at the same time ready to enter upon any new branch of industry calculated to improve their present condition.

Singra or lower
Coal-field.

The Caile* or Palamow river, joins the Soane at the outlet of the valley, about 80 miles from the confluence of the latter river with the Ganges, and is perfectly navigable for ordinary boats during the rains to a place called Manjean, 18 miles within the valley; above this the navigation becomes more difficult in consequence of the occasional projection of rocks into the stream, but boats of 150 maunds burden can with ordinary caution ascend during the rains 22 miles higher to the village of Singra where the first Coal-field occurs, accompanied, according to Mr. Homfray, with a rich and inexhaustible iron ore. This Coal-field is, however, only two and a-half miles long and one mile broad; the main Coal,† which is not far from the surface, is 3 feet 8 inches thick, and though not reckoned of a quality exactly fitted for getting up steam, yet would answer admirably for the reduction of the ore with which it is associated.

Upper Coal-field.

In order, therefore, to obtain inexhaustible supplies of Coal suitable for steam navigation, it is necessary to ascend 20 miles still higher up the Caile, where a great Coal-field, indicated by Rennell in his map of Bengal, occurs, and which is supposed by Mr. Homfray to be 14 miles in length by 6 in breadth, with a workable main of good Coal 3 feet 9 inches; but, unfortunately, the navigation of the Caile is quite obstructed by boulders from Chandoo to the Coal-field, a distance of 13 miles,‡ and the country on either side so rugged as to prohibit the possibility of forming a road at any moderate expense, and the only practicable mode of conveyance would, consequently, be bullocks, which, on such difficult passes, could, according to Mr. Homfray, only carry half the ordinary loads,§ and for the rest of the way, *i.e.*, from Chandoo downwards, small boats of 150 maunds, with caution, could traverse the river to Manjean, as already stated, where large boats during the rains might receive their cargoes.

In order to overcome the difficulties opposed to the navigation of the Caile, several expedients have been proposed. That of Captain Sage, of forming a bund at Ganeah Ghat, where, for three miles, the river is obstructed, would, if successful, only have the effect of obviating a portion of the difficulty to be encountered; for the rest, he suggests the formation of a cut from the bund across the table-land, for the distance of 30 miles, to the nearest branch of the Great Ponpon river, the bed of which should be levelled and locked the whole way to Futwa on the Ganges; or instead of the last part of the proposition, to remove, by means of gunpowder, the impediments to the navigation of the Caile at Manjean, below the situation of the proposed bund.

This last is certainly the more feasible plan, but before either of the modes proposed for bringing the Palamow Coal into use for the navigation of the Ganges, be carried into effect, it would be necessary first to know whether or not the mineral

* It is sometimes called Caile, and in Arrowsmith's map, Coyle, a name which in the same map is also bestowed on another neighbouring river.

† We use Mr. Homfray's term although we have no details sufficiently satisfactory to prove that the bed alluded to is the *main* Coal. On the contrary, it appears to be merely the crop Coal as well from its superficial position as from its quality and appearance.

‡ A considerable proportion of this distance, comprising a tract of two or three miles at least adjoining the Coal-field, appears from a map, constructed by Mr. Homfray, to offer no difficulties to the formation of a road.

§ From Chandoo in a direct line to the Coal-field, the distance would seem from Mr. Homfray's map to be considerably less than 13 miles, and if the plain adjoining the Coal-field be deducted, the really difficult part of the distance would probably be much diminished; and when we recollect, that good roads are made in Kemaon, for instance, with less important objects over mountains 7,000 feet in height, it is easy to see, that a ridge of hills a few hundred feet high, however rugged, will not form an insuperable obstacle to the useful application of the Palamow Coals.

mineral can be had in situations more accessible ; if not, some ingenious plan will, no doubt, sooner or later, be devised for bringing this Coal into use.

The lower Coal-field appears to have been originally a slightly inclined plane, composed of sandstone, shale, and Coal, disposed in horizontal beds, in which streams have worn ravines to a depth of from 20 to 60 feet, giving to the present surface a broken and uneven aspect. On the sides of the undulations, and in the ravines Coal bassets are everywhere seen.* There would seem to be above the Coal, a sandstone 38 feet in thickness, intersected in the middle of its depth by a minor bed of Coal and shale, beneath which a 2 feet 6 inch bed of Coal occurs ; an alternation of sandstone and shale divides this from the main Coal, beneath which there is 60 feet of sandstone. The rocks associated with Coal, in the upper field, do not appear to be very different from those which compose the lower one, except that the sandstones would seem to be finer and harder in the former. Only two beds of Coal, the one 3 feet 9 inches, and the other 1 foot 6 inches are given in its section by Mr. Homfray.

Mr. Tytler, an engineer, employed under the Controller of Steamers, having been deputed, under the authority of the Marine Board, to Palamow, describes a bed of Coal six feet thick, exposed, to a great extent, on the banks of the Amath river, where Mr. Homfray, a short time before, could only find a 3½ feet bed, “so interrupted by ravines as to render the field very limited.” There is, however, evidence enough in the Reports of Major Sage and Mr. Tytler, as well as in the information furnished to Mr. Ravenshaw, the Commissioner of Patna, to show that Coal is here abundant enough ; the only doubt is, as to its quality. Major Sage, Executive Engineer, Dinapore, states that he had formerly been in the habit of receiving supplies of Coal from Palamow, which he considered a good and useful fuel. We have no doubt that a good Coal may be procurable in Palamow, but such samples as have been hitherto sent to Calcutta for trial have been inferior ; partly, no doubt, from their having been ill chosen from the numerous beds that seem to occur in the district. Major Sage found the following results, from comparative experiments instituted between Palamow and Burdwan Coal, from which it would appear that the former has the advantage in quality:

	Palamow.						Burdwan.					
Coke	-	-	-	46	2	-	-	-	46	2	-	-
Volatile matter	-	-	-	47	-	-	-	-	40	-	-	-
Earthy matter	-	-	-	6	8	-	-	-	13	8	-	-
	100						100					

Palamow Coal-field, 1840.

Nature of the Palamow Coal-field.

Quality of the Coal.

Palamow compared with Burdwan Coal.

In experiments of this kind on a small scale, everything depends on the specimens selected for comparison. The Burdwan Coal varies in quality in different mines, just as Palamow Coal would vary if mines were once fairly established in that district.

The best Burdwan Coal we can induce the Contractor who supplies the Laboratory of the Honourable Company's Dispensary to furnish, affords 25 per cent. of ashes, but the kind used on board steamers is said to be very superior to this, and the Ranyunge variety with which other Coals are compared, is the best in Burdwan.

* The following computation of the Section has been made by Mr. Homfray, from the appearances on the surface of the ravines :—

SURFACE.							
				Ft. In.			
Sandstone	-	-	-	20	-	Ironstone Measures. } Ft. In.	
Coal	-	-	-	1	4		
Shale	-	-	-	-	10		
Sandstone	-	-	-	18	-		
				Ft. In.			
Coal	-	-	-	10	-	Sandstone very white } - - - - -	
Stone	-	-	-	8	3		
Coal	-	-	-	1	8		
Shale	-	-	-	3	-		
Sandstone	-	-	-	8	-	Aluminous Sandstone } - - - - -	
Coal	-	-	-	3	8		
Shale	-	-	-	3	-		
Sandstone	-	-	-	60	-		
Assumed Measurement	-	-	-			Quartz and beneath it granite.	

Palamow Coal-field, 1840.

Disadvantage of all new Coals at first.

Burdwan. Much judgment is therefore necessary in selecting samples for trial from new Coal Districts, when the object is to compare them with Burdwan Coal. Whatever Coal it has been customary to use, will always have the advantage of a new Coal in such trials, inasmuch as the form of the furnace, and the manner of keeping up the supply will be such as are suited to the old Coal, while the necessary experience is wanting with regard to the most favourable circumstances for burning the new.

If the draught of the furnace be too great for the Coal, the fire will burn down too rapidly, and the Coal will be wasted in an unnecessary quantity; and if not sufficient, the fire will burn too slowly, and the stoker, perhaps accustomed to throw in fresh fuel at certain intervals, will keep the fire choked, so as to require more frequent stoking than necessary, and (as Colonel Presgrave remarked on the late trial of Palamow Coal) every time the door is opened for this purpose, a volume of cold air enters, the effect of which is to lower the steam.

On board the Jumna steamer, 13th March 1840, three samples of Palamow Coal were tried, one furnished to Mr. Ravenshaw by Cazee Mohumdee, mixed however with Chupree Coal, and the other two from Mr. Tytler; the first seemed to answer best, though evidently raised without judgment, and mixed with shale. The faults of this compared with the best Burdwan Coal were, that it required a much larger quantity to keep up steam, and that it ran into slags or clinkers, which choked the bars of the furnace. This last defect may have been owing to the Coal being mixed,* and perhaps would not have taken place had the bars of the furnace been wider apart. Mr. Tytler's sample from lower Miral appeared to burn very freely, but compared with the best Burdwan Coal, twice the quantity was required to keep up steam. On a third sample from Upper Miral being tried, it was found that even with an excessive consumption of the fuel, it could not keep the engine at full work. The value of these experiments will, however, depend on two circumstances, namely, whether the samples tried were the best that could be chosen, and whether the furnaces of the Jumna are as well suited to the nature of the Coal as any that could be constructed.

Miral Coal.

Mr. Ravenshaw thinks he could procure a contract for the supply of Palamow Coal at Dinapore for six annas per maund, it would therefore be of some importance to have the question of its quality fairly set at rest.

SOANE RIVER.

Soane River, 1841.

Dearee, or Chupree Coal.

In a letter from Mr. Ravenshaw, Officiating Commissioner of Patna, to the Government of Bengal, dated 6th January last, that gentleman states that a Cazee had found a bed of Coal at a place called Chupree, four miles from Dearee on the Soane, near its junction with the Gail, and estimated the expense of delivering Coal from this bed to Dinapore to be five and a half annas per maund. On this information 300 rupees were advanced to the Cazee to enable him to commence operations; but after extracting 100 maunds, precisely similar to Palamow Coal, the bed is said to have assumed a slaty character, and the Cazee abandoned his operations. If the Cazee's statement regarding the existence of Coal so near the Soane be correct, the circumstances under which it occurs ought to be fully investigated. On some old maps a Coal Mine is marked in this vicinity, and judging merely from the samples produced by Mr. Ravenshaw, there can be little doubt of the existence of good Coal wherever those samples were raised.

* A small quantity of carbonate of lime or soda would have the effect of rendering the earthy parts of Coal fusible. We think in another trial of Mr. Ravenshaw's mixed Coal, we could easily select the pieces which formed slags from the general mass, as they are covered on the surface with an efflorescence of soda. We think they belong to Singra, one of the Palamow beds, and the peculiarity is probably very local.

ABSTRACT of the PROCEEDINGS of the COAL COMMITTEE, from May 1839
to May 1841.

At a Meeting of the Committee, held 23d May 1839.

Present:—C. W. Smith, Esq., President; Major Henderson, Major Forbes, Captain Johnston, and the Secretary. Proceedings.
May 1839.

1. CAPTAIN JOHNSTON informed the committee that the Marine Board, under the orders of Government, had authorised the despatch of 50,000 maunds of Cherra Ponjie Coal to Calcutta, and that funds for that purpose had been placed at the disposal of Mr. Loch. This is an object the committee had long been anxious to accomplish, with a view to give the coal a full trial.

2. The following announcements of discoveries of Coal were then made.

3. A discovery of a new bed on the island of Rambree, communicated by Captain Bogle, Commissioner of Arracan, together with several maunds of the Coal which is found on the bank of a navigable creek about six miles south of Rambree town. The Coal proved of excellent quality, but information is wanting as to the extent of the bed and facilities for working it. Hoong Coal,
Arracan.

4. A discovery of a new bed of Coal near the village of Mamloo, communicated by Mr. G. Loch. This bed is situated more conveniently with regard to carriage than the Cherra Ponjie Coal. Sylhet.

5. A specimen of Salt and Coal from Salt springs and Coal beds on the Dhunsiri river, in Assam, presented by Captain Jenkins. These specimens were found by Mr. Grange in his late expedition to the Naga mountains. The Coal now presented confirms previous indications of the existence of extensive beds on the banks of the Dhunsiri, which is a larger and more manageable river than either the Dihing or Dysung, on which valuable Coal beds were previously found. Assam.

6. In expressing the thanks of the committee to Captain Jenkins, for his long and constant endeavours in promoting its objects, the secretary was requested to consult him as to the measures he would propose for establishing depôts of Coal on the banks of the Bramaputra, supplied each with 20,000 maunds, for such public exigencies as might occur.

7. Mr. Pontet presented to the committee a series of specimens exhibiting a section of his excavation in search of Coal on the Burmany Nulla, about 30 miles west of Moorshedabad, at the southern foot of the Rajmehal hills. The specimens consist of Coal shale with impressions of Coal plants, and sandstone of the Coal measures, as well as clay ironstone. The excavation was carried to a depth of 40 feet, the first 23 feet being yellow clay with dark bituminous layers. Doo Bradgepore Coal.

The remaining portion of the excavation as follows:—

Thin seam of Coal	-	-	-	-	-	-	-	-	-	} So many layers alternating from the depth of 23 ft. to 40 ft. from the surface.
Shale containing plant impressions	-	-	-	-	-	-	-	-	-	
Hard shale without fossils	-	-	-	-	-	-	-	-	-	
Hard coarse sandstone	-	-	-	-	-	-	-	-	-	
Good Coal in thin seam	-	-	-	-	-	-	-	-	-	
Bituminous shale containing impressions of plants, particularly <i>Vertabraria indica</i>	-	-	-	-	-	-	-	-	-	
Hard bituminous shale with layers of sandstone	-	-	-	-	-	-	-	-	-	
Clay ironstone	-	-	-	-	-	-	-	-	-	
Hard sandstone	-	-	-	-	-	-	-	-	-	
Good Coal in thin seams	-	-	-	-	-	-	-	-	-	
Sandstone alternating with layers of shale	-	-	-	-	-	-	-	-	-	

8. Iron ore was announced as received from the Tenasserim provinces for trial, and a memorandum regarding it presented by Captain Johnston from Mr. Blundell.

June 1839.

A. Meeting of the Committee took place at the President's Quarters, 3 June 1839, when the Members already enumerated attended.

Iron ores.

1. WITH a view of making experiments on the yield of the Tenasserim iron ore, alluded to in the 8th paragraph, proceedings of the last meeting, Major Forbes proposed that an application should be made for the sanction of Government to the erection of a smelting furnace in the vicinity of the Mint. Major Forbes conceived that by means of such a furnace, experiments on the comparative value of the different iron ores of the country could be made, and results of a practical nature obtained. The following are Major Forbes' remarks on this subject :—

2. "With a view to making experiments on the yield of the iron ores sent to the Mint, I have to request the approval of the committee for an application to Government requesting the requisite sanction for my constructing in the vicinity of the iron foundry attached to the Mint, a small iron smelting furnace, which can conveniently be worked, as regards blast, by the powerful blowing machines there erected, and driven, as circumstances require, either by a 14 or 40-horse power steam engine, at present used for the iron melting cupolas employed in making various descriptions of castings from pig-iron sent out from England.

3. "By means of such a smelting furnace, the comparative value of the pig-iron obtainable from the different ores of the country would be readily ascertained, and the pigs derived from them could immediately be rendered available; and such an examination of the country iron ores would obviously be advisable as the means of beneficially directing capital to the sites in which, with most certainty, profitable iron works could be established.

"Without so heightening the largest of the present Mint cupolas as to render it unfit for the purposes to which it has hitherto been applied, and for which it is required, the class of experiments alluded to could not be made, but for the purpose of large castings from pig-iron of any description, the kind of smelting furnace proposed (besides the making of pig-iron direct from the ores) would be serviceable. The cost of such a furnace, as shown by the plans and estimates subjoined, would be *Co.'s Rs. 1,945. 10.*"

Meeting of the Coal Committee, held 5th August 1839,

August 1839.

Present :—C. W. Smith, Esq., President; Major Henderson, Major Forbes, Captain Johnston; and Mr. McClelland, Secretary.

Colonel Presgrave was prevented by indisposition from attending.

Tyroo Ghat Coal,
Assam.

1. THE secretary brought to the notice of the committee a letter from Captain Jenkins, dated 12th July 1839, which accompanied specimens of Coal found by Lieut. Brodie near Rungpore, at a place called on Pemberton's map, Teroogong, of which a description and analysis is annexed. Particulars of this discovery are to be forwarded hereafter by Captain Jenkins. The locality seems to be a little west of that from which the first Coal sent to Calcutta from Assam had been taken, which was a small branch of the Dysung river, called the Suffry. This seems to be the fifth locality in which Coal has been found under workable circumstances in Assam; and Captain Jenkins expresses a hope that a practical person, capable of opening mines and conducting all the necessary operations for the delivery of the Coal, may be sent into Assam, in order that a good stock of Coal may be provided on the banks of the Bramaputra for emergencies.

Hoong Coal, Arra-
can.

2. Captain Bogle, in forwarding to the committee a report from Lieut. Lumsden, in which the several localities where Coal has been observed at Arracan are enumerated, also observes that it is impossible to extract Coal from any beds in that quarter, unless the Government will send practical persons to conduct the necessary operations. Lieut. Lumsden's report makes us acquainted with the circumstances of the discovery of Coal south of the town of Rambree, which has been already adverted to; he himself only found the vein of Coal a foot in thickness, and commenced sinking a pit, but found the place so hot that he was obliged to trust the rest to a native, who, a few days after, brought to him 120 maunds of the Coal which Captain Bogle last submitted to the committee. Mr. Lumsden has seen this Coal used in a smith's forge, and finds it nearly free from pyrites (the general fault of former samples of Arracan Coal), although the blacksmith complains that it works badly, but Mr. Lumsden thinks it would answer for steamers, and also expresses a hope that the interest now excited in favour of Arracan Coal, will lead to some arrangements for its thorough investigation. Mr. Lumsden says two superintendents from Burdwan mines, with a couple dozen of miners, would set the matter at rest in one season.

3. Although it would be desirable that the committee should have more specific information regarding the precise localities of Coal, the thickness of the beds and their probable extent, together with the quality of the mineral in each particular locality, before recommending the adoption of any practical measures that might be attended with a weightier outlay

outlay than has hitherto attended the operations of the committee, yet it certainly appears necessary to develop the practical utility of the various indications of Coal that have been observed in different provinces, and that some steps should be taken by deputing practical persons for the above objects.

4. The difficulty of the committee consists in finding persons every way suited to the peculiar duties required. The members of the committee undertook to make inquiries and to communicate the result, so that after ascertaining the salary and qualifications of different individuals, their names might be submitted to Government, with proper recommendations. In the meantime, the secretary was desired to communicate to Captains Bogle and Jenkins, the intention of the committee to meet their wishes as much as possible.

5. Letters were read by Captain Johnston from Mr. H. Inglis, in reply to the Marine Board, stating that the want of practical superintendence of the mines at Cherra must cause a temporary suspension of operations, and prevent the possibility of providing by the end of the rains above half the quantity of Coal required, that is, 10,000 maunds; in consequence of the Coal having been excavated from the lower part of the precipice in which it occurs, all the superincumbent beds of clay and rubbish slipped down so as to bury it. It was suggested at the committee that a practical person should be sent up to Cherra to superintend the works, and Captain Forbes mentioned a Mr. ———, with whom he was requested to communicate.

6. With reference to the bed of Coal which Mr. Loch alludes to (June 1839, paragraph 4) as having been discovered below the village of Mamloo, about 10 miles west of Cherra, nothing has been heard since Mr. Loch left the Sylhet District; the secretary is therefore requested to communicate with Major Lister on the subject. Byrung Ponji.

7. Received from Captain Johnson, for perusal, an elaborate report of Mr. Tytler, announcing the discovery of a bed of Coal on the Amanath, near the village of Mirall, and close to Singra, the place visited in 1836 by Mr. Homfray. The bed is said to be of good quality and inexhaustible, six feet two inches in thickness. The specimen forwarded to the committee appeared to be a dull, slaty Coal. Captain Johnston was requested to convey the thanks of the committee to Mr. Tytler, who is employed under the orders of the Marine Board, as well as to communicate to the committee the result of Mr. Tytler's present inquiries into the facility with which the river Soane can be navigated; and the secretary was requested also to communicate with him on the subject of the Palamow Coal. Mira or Singra Coal,
Palamow.

8. Specimens of iron ore from Tyroo Ghat, in Assam, occurring along with the Coal, together with a sample of the iron manufactured from it, were submitted to the committee.

9. Also iron ores from Palamow, sent by Mr. Tytler, for which the Secretary is directed to return the thanks of the committee.

10. A report from Lieutenant Hutchinson, addressed to Mr. Blundell, and forwarded through Captain Johnston to the Coal Committee, was read. It relates to the specimens of anthracite received some time since from the Tenasserim Coast, which is proved by Lieutenant Hutchinson to be a detached nest of anthracite imbedded in clay, and of little value, further than as an indicator of larger beds, perhaps, in some part of the surrounding country.

11. Major Forbes presented an interesting specimen of the anthracite of Poltsville Mines, about 100 miles north-east of Philadelphia, to the committee.

12. Specimens of serpentine from the Punjab, forwarded by Mr. C. Masson, were then submitted, together with a specimen of flexible asbestos from Kanigoram, said to be a Coal locality, west of the Tokht Saliman range.

13. The secretary announced the sanction of Government to the erection of an experimental furnace for smelting native iron ores at the Mint, together with a disbursement of 250 rupees for the purchase of 500 maunds of Cherra limestone, as flux for the same.

14. Mr. Blundell, the Commissioner of Tenasserim, informed the committee that he has shipped on board the "Ganges" 40 tons of a coal recently discovered near Mergue, the expense of which to Calcutta will not exceed eight annas a maund, or 5½ annas at Mergue. The particulars regarding the discovery of the Coal in question have not yet reached the committee; but Mr. Hutchinson's report on the subject is said to be before the Government.

At a Meeting of the Committee, held on Monday, 9th September 1839,

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson,
Major Forbes, Captain Johnston, and Mr. McClelland, Secretary.

September 1840.

THE question, as to how far it is the duty of the committee to recommend the employment of practical men in opening Coal Mines in Assam and Arracan, was discussed, as well as the possibility of obtaining persons every way fit for such a duty, and who the com-

mittee could undertake to recommend. It was agreed that Mr. A. Landers should be recommended for Assam, where practical assistance appeared to be most required. Memoranda were then submitted to the committee on the trial of the following Coals by Captain Johnston:—

1. Samples of two Coals from Palamow, on the Amanath River, called Upper and Lower Miral Coal.

Both kinds burnt so slowly that it was impossible to keep the steam up from either, but mixed with Burdwan Coal, they answered very well. In a furnace with a better draught, Captain Johnston thinks either of the above Coals would answer. Captain Johnston next tried a sample from the same vicinity, also sent to Calcutta by Mr. Tytler as anthracite. This Captain Johnston found to burn when mixed with Burdwan Coal, but to ignite very slowly of itself. If the draught of the furnace in the river steamboats were improved, these Coals, Captain Johnston thinks, would become valuable fuel.

2. Captain Johnston then submitted, a memorandum regarding Tenasserim Coal, to the effect that the Coal worked by Lieutenant Hutchinson is equal to the best Burdwan.

3. A third memorandum from Captain Johnston, stating that only one tender had been made to the Marine Board for the supply of Cherra Ponjie Coal at 12 annas per maund, and that with certain stipulations which could not be complied with; also that 8,000 maunds of that Coal is in course of being supplied to Assam, in consequence of the loss of the boats despatched with Burdwan Coal to that province.

4. A specimen of iron ore, found by Mr. Blundell two days' journey from the town of Tarsey, with every facility for water-carriage, was presented; also a specimen of lead ore from the banks of the River Salmeen.

Meeting of the Coal Committee, 7th October 1839,

October 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave Major Henderson, Major Forbes, Captain Johnston, and Mr. McClelland, Secretary.

1. READ an extract of a letter from Mr. Jameson, assistant surgeon, announcing the existence of Coal formations along the foot of the hills, south-east of Umbala, and Mr. Jameson expresses his confidence of finding good workable Coal beds in that direction, which will, he considers, prove of the highest importance to the navigation of the Indus. Mr. Jameson is preparing a report on the subject for the Government.

2. A letter was read from the Government, in reply to the committee's recommendation of Mr. Landers; that gentleman is to be employed under the Commissioner of Assam in opening the Coal mines in that province.

3. Read a letter from Captain Jenkins, accompanying specimens of Coal found near the banks of the Dunsiri River, in a line nearly between Dezova and Chumakotee, in large quantities. The specimens are slaty and indifferent looking Coal.

4. Read a letter from Mr. Turner, in reply to queries on the manufacture of steel, and offering his service at 400 rupees a month. Mr. T. announces his having despatched specimens of iron used in the manufacture of steel, illustrative of the process.

At a Meeting of the Coal Committee, held at the President's Quarters, 4 November 1839,

November 1839.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Mr. McClelland, Secretary.

Coal west of Tyroo,
in Assam.

1. READ a letter from Mr. Brodie to Captain Jenkins, announcing the discovery of a new bed of Coal, a good deal west of Tyroo, and much nearer Deko. It has the advantage of being a Naga village; and Mr. Brodie thinks it is more than probable that we should be able to make contracts with the Nagas to convey it down to the river. He seems to think there are some places nearer to Diko still; but whether this be the case or not, says Mr. Brodie, "I look upon this Coal as the most valuable yet discovered in Assam, from its vicinity to populous villages, and the ease with which the Coal may be transported to the great river."

2. Read a letter from Mr. Goldie, executive engineer of Moorshedabad, to whom the committee referred on a former occasion, stating his inability to afford any information regarding the Coal discovered by Mr. Pontet, in the Rajmehal hills, as his duties do not admit of his leaving Moorshedabad.

3. Major

3. Major Lister's communications of 17th having been circulated in the Committee, it was agreed that the secretary should write to thank him for the information he had given, and point out that as Mr. Landers is now appointed for the special purpose of working the Cherra and Assam Coals, it may be in his power to instruct the Kassiahs in the art of mining, so as to render it unnecessary to send native miners to Cherra, as Major Lister suggests. No miners being available, the Committee were desirous of ascertaining whether military sappers and miners could be had if applied for; but found, on reference to Colonel MacLeod, the chief engineer, that there are none to be had; we must, therefore, trust to the success of Mr. Landers in instructing Kassiahs and natives of Assam in the art of mining.

4. With reference to the box of specimens stated to have been forwarded without address by Mr. Turner, as per custom master's receipt, 21st September 1839, the secretary was ordered to apply to the custom master of Quilon to know by what ship the package in question has been forwarded.

5. It was suggested by Major Forbes, that the remarks in Mr. Turner's letters regarding the manufacture of iron be collected and published. See Appendix.

At a Meeting of the Committee, held 9th December 1839,

December 1839.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Captain Johnston, and Mr. M'Clelland, Secretary,

PAPERS were read on the preparation of an artificial fuel which had been tried by Lieutenant Lynch, I. N. The fuel is composed of the charcoal of tamarisk wood, pounded and mixed with hot petroleum. The materials being both very common on the banks of the Euphrates, this fuel might be used probably with advantage in the navigation of that river.

2. The secretary was requested to ascertain the expense of making such fuel in Calcutta.

3. The following experiments on the Coal of Byrung Ponjie, and remarks by the secretary, were read, when it was ordered to send a copy to Major Lister and to enjoin careful examination of these beds by Mr. Landers.

4. Two specimens of Byrung Ponjie Coal alluded to by Major Lister in his letter of 17th October last, as forwarded to the Coal Committee by Dak Banghy.

This Coal, as stated by Major Lister, is within two miles of water carriage, with facilities for the construction of a road for hackeries to the pits. The beds are said to be from two to four feet in thickness. Byrung Ponjie Coal.

No. 1. Specific gravity, 1.3.

Inflammable matter	-	-	-	-	-	34
Carbon	-	-	-	-	-	64.5
White ash	-	-	-	-	-	1.5
						100

Note.—One pound of this Coal was ignited in a table furnace and burned with a clear bright flame, caking very freely until the whole was consumed to cinders.

No. 2. Specific gravity, 1.28.

Inflammable matter	-	-	-	-	-	25
Carbon	-	-	-	-	-	29
Earthy matter	-	-	-	-	-	46
						100

A. No. 2. Inflammable matter	-	-	-	-	-	30
Carbon	-	-	-	-	-	50
Earthy matter	-	-	-	-	-	20
						100

Two pounds weight of this last specimen was found to burn slowly without caking, and left one pound nearly of cinders and white slaty ashes, &c.

5. The two last specimens were the same Coal; the first unadulterated with earthy matter, should be considered a distinct Coal, from a different bed, but Major Lister does not state whether there are two beds or only one.

6. These three specimens, taken as a whole, are not to be regarded as useless Coal, even for steamers; and from their locality, they might be had for a very low price indeed. Under these circumstances Major Lister ought to be written, and asked to employ Mr. Landers in a diligent examination of the place, and also in raising a few hundred maunds, or a few thousand, according as he might find the quality improve on working, and have it ready for transmission according to orders that might be hereafter sent to Major Lister, and in the mean time to keep us acquainted with his progress. Major Lister, it will be recollected, states in his letter above alluded to, that other beds of coal are spoken of in still more favourable spots; Mr. Landers should be enjoined to visit them, and endeavour to satisfy himself as to their value.

7. Major Lister, it will also be recollected, stated that until an improved method of working the Cherra Coal could be effected, he could not recommend any outlay for the improvement of the road. Now that he has Mr. Landers, he thinks he will be able to learn from him what improvements the working of Cherra Coal will admit of, and what chance of a better Coal being found below; and it is of importance that these points should be decided at once, so as to get something done between this and April with regard to Sylhet Coal.

8. A proposal, under certain stipulations, by Mr. C. B. Taylor, to supply Palamow Coal of good quality at Dinapore, was read and ordered to be submitted to the Government.

9. Read by Captain Johnston a paper on anthracite, by the owner of an anthracite mine in England; also an extract from the letter of Mr. Young to Captain Johnston on the same subject.

At a Meeting of the Coal Committee held at the President's Quarters, 10.30 A.M.,
Monday, 6 January 1840,

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, and Captain Johnston, and Mr. McClelland, Secretary.

January 1840.

1. TEN maunds of coal received from Major Lister as a further sample of the produce of the new mine at Byrung Ponjie, at the foot of the Cossia Hills, alluded to in the proceedings of the last meeting, was received, and a portion of it tried*. It appears to be an excellent light Coal, of the same quality as that of Cherra Ponjie, but somewhat more ferruginous in its appearance. It was agreed to offer the thanks of the Committee to Major Lister for this very encouraging sample of coal, and to inform him that in the opinion of the Committee, the sample appears to be well adapted for steam purposes.

Artificial fuel.

2. The secretary, according to the two first paragraphs of the proceedings of the last meeting, reported that the charcoal of mangoe wood, the cheapest sort to be had in Calcutta, requires, when powdered, one-third more than its own weight of petroleum to convert it into the solid form of brick fuel, such as that proposed by Lieutenant Lynch.† The mixture, however, burns with a bright, clear, and durable flame. Petroleum in the Calcutta market is brought from Ava, and sells at 15 rupees per maund, which would make the artificial fuel too expensive, except in places where petroleum is plentiful, as on the Euphrates.

3. Petroleum is, however, a production of Coal districts, and wherever it is found Coal may be also expected; and it is highly probable that extensive springs of petroleum on the Euphrates may be connected with equally extensive Coal measures in that quarter.

At

* The following are the results of analysis of this sample :

Specific gravity, 1.30.	
Inflammable matter - - - - -	51
Carbon - - - - -	42
Earthy and ferruginous ash - - - - -	7
	100 parts.

This, though from the surface, is a capital Coal, and being situated at the foot of the Cherra Hills, will be nearly 4 annas per maund less than Cherra, and consequently the cheapest Coal in India for use in the Bengal Provinces, if the bed proves sufficiently extensive to admit of being worked on a large scale. This there is every hope, will prove to be the case.

† Vide Proc. 9th December 1839, para. 1.

At a Meeting of the Coal Committee, held on Monday, 3 February 1840,

February 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes; Captain Johnston, and Mr. McClelland, Secretary,

THE following Reports from Colonel Presgrave and Major Forbes were received regarding the quality of Major Lister's coal from Byrung Ponjie.

1. *Colonel Presgrave's Report, Cossipore Foundry, 29th January, 1840.*—Specimen of Major Lister's Coal received for trial from Mr. Secretary McClelland, 2 cwt. 2 qrs. 10 lbs., chiefly small and dust, kept up the steam of the 14-horse engine for 1 hour and 40 minutes; the Coal seems to be of good quality, but from its broken, dusty state, the sample afforded a less favourable result than it would otherwise have done. The same weight of picked Burdwan Coal kept up the steam in the same engine for 1 hour and 52 minutes. Byrung Coal.

2. One hundred parts by weight of Major Lister's Coal produced 68.75 of good coke, or in other words 2 lbs. of the Coal yielded 1 lb. 6 oz. of coke as per muster laid before the Committee; this is the only muster of country Coal that I have heard of as affording coke.*

3. *Major Forbes' Report.*—"The Coal sent by Dr. McClelland from Major Lister on the 14th January last for the Mint Master's opinion has been tried for a smith's fire, and a very good heat was taken by it; the Coal is very much like the steam Coal in use for steam vessels, and is the best country Coal I have seen, 1st February 1840.†

4. The secretary was requested to send to Major Lister an extract of this part of the proceedings, and to inform him that we are anxiously waiting for information regarding the extent of the mine, and the chance of getting large supplies of Coal from this very desirable locality.

5. The secretary was directed to write to Mr. Ravenshaw for further information regarding the Chuppre or Dearee Coal, and to Captain Jenkins and Major Lister regarding Lieutenant Lynch's method of making artificial fuel, and soliciting information from them as to the expense of making it on the spot where petroleum is found.

6. Captain Johnston exhibited a specimen of artificial fuel, regarding which he is to furnish information at the next meeting.

At a Meeting of the Coal Committee, held 9 March 1840,

March 1840.

Present:—C. W. Smith, Esq., President; Colonel Presgrave, Major Henderson, Major Forbes, Captain Johnston, and Mr. McClelland, Secretary.

1. It was stated by Mr. Smith, that Mr. Mills, the Commissioner of Cuttack, had undertaken to procure samples of the Coal recently brought to notice in that quarter, but that it would be attended with an expense of 200 or 300 rupees as travelling charges to the individual deputed, which the Committee would recommend for the sanction of the Government.

2. Captain Johnston read an extract of a letter from a friend in England on improved furnaces for burning anthracite, and promised an extract for the use of the Committee.

3. Read a letter to Major Lister from Mr. Landers, his assistant, stating, that the want of proper implements prevented him from ascertaining the extent of the bed of Coal at Byrung, and that there is also an inferior Coal found at Cheela, another situation at the foot of the Cherra Hills. Mr. Landers states that he intends to submit a plan which will simplify the carriage of the Cherra Coal from the mine to the foot of the hills; and Major Lister observes, that if Coal be required this season, it will be necessary to obtain it from Cherra, and that Mr. Landers is only waiting the arrival of the necessary implements in order to commence operations. Major Lister is of opinion that no great difficulty would be encountered in constructing a bullock road from the Coal to the brow of the precipice, and again from below the precipice to water carriage, and converting the intervening space, about 1,000 or 1,500 feet, into a slide.

4. Major Lister also states, that Mr. Inglis, of Chattach, has found a new bed of Coal, at an elevation of from 1,500 to 2,000 feet, so convenient to water carriage, that a coolie can make five trips in a day; locality of the mine is above Choila, at a village called Mustuk. Mr. Inglis is of opinion that the Coal is quite as good as that of Cherra, and has already despatched a boat laden with it to Messrs. Fergusson and Co., Calcutta, to ascertain its market price.

Discovery of
Mustuk Coal.

5. Before

* Signed by Colonel Presgrave, Superintendent Cossipore Foundry.

† Signed by Major Forbes, Mint Master.

5. Before any expense is incurred in improving the road, the Committee think it ought to be clearly ascertained whether an equally good Coal cannot be obtained from either the Mustuk or the Byrung beds, which have the advantage of being nearer to water carriage, and consequently promise to yield cheaper supplies.

With regard to the 2d paragraph of the January proceeding, Colonel Presgrave suggested the advantage of making coke from these Coals on the spot, for the use of the Cossipore Foundry and the Mint.

6. Read a letter from Government enclosing extract of proceedings of His Excellency the Honourable the President in Council in the Political Department, under date 5th February 1840, by which the Committee learn that Lieutenant Hutchinson, Artillery, has been appointed to superintend the opening of Coal mines on the Great Tenasserim river in Mergue, and that he requires boring rods and pumps, which have already been granted, Major Forbes suggested that two small steam engines of 20 and 10 horse-power respectively, were available, and if necessary he proposed to fit either of them up at the Mint with pumps, &c., for lifting water. Mr. Blundell, however, says, that in the first instance he is desirous of avoiding expensive machinery, and the Committee are of opinion that as the Coal is within 10 feet of the surface, engines cannot be requisite, and that the bed may be worked like Crop Coal, i.e., sinking pits down to the Coal and raising it at once, then undermining on all sides as far as it is safe to do so merely with props; when the Coal is thus taken out the props are withdrawn, and the roof allowed to fall in. A new pit is then formed, and the same process continued.

7. Reports were received from Major Sage and Mr. Ravenshaw on the subject of Palamow Coal, and a new bed recently found within two coss of the Soane river, of which a sample had been sent to Calcutta for trial. These Reports to be further considered, and brought up again at the next meeting.

8. It was arranged with Captain Johnston that several new Coals should be tried on board the Jumna steamer on Thursday next.

April 1840.

At a Meeting of the Coal Committee, held at the Audit Office, Monday, 6 April 1840,

Present :—Major Henderson, Major Forbes, and Mr. McClelland.

Mr. Smith had left Calcutta for Chittagong, and Colonel Presgrave and Captain Johnston prevented by indisposition from attending.

1. THE secretary submitted a summary of what had been done in the Committee on the subject of Coal since the last general reports were drawn up.

2. Major Forbes stated that the cargo of new Coal from Mustuk despatched by Messrs. Inglis and Co. for trial, had arrived, and that the quality appeared to be excellent for smithery purposes, and that trials were now in progress as to its fitness for getting up steam.

3. Major Forbes pointed out in a Report on the Rajmehal Canal by himself and Colonel McLeod, dated 1st July 1832, some information regarding Coal in a most favourable quarter of the Rajmehal Hills, situated to the north west of Moorshedabad. The following is an extract from the Report alluded to:—"At the pass of Patchwary, 14 miles to the westward of Maishpoor, on the Bansli Nulla (which enters the Bhaugarutty above Moorshedabad, we are informed by Mr. Ward, the Commissioner of Boglepore, that there is a bed of sandstone with here and there specimens of a very excellent kind of Coal, which must abound in that part of the country, &c."

Patchwary Coal.

4. A letter from Mr. Mills, Commissioner of Cuttack, to C. W. Smith, Esq., announcing that Mr. Beetson whom he deputed at the request of the Committee to the Coal in the Gopalpashad district, near Talachergurb, on the Bhamini river, had found Coal of an excellent quality, which may be delivered at Hansooh, on the Coast, at 3 or 4 annas per maund, and from thence the conveyance to Calcutta would be 17 or 18 rupees per 100 maunds. Mr. Mills has authorised Mr. Beetson to send a trustworthy person to dig 100 maunds for transmission to Calcutta for trial in December next, which arrangement he hopes the Committee will approve of.

Cuttack Coal.

5. A letter from Mr. Landers to Major Lister was laid before the Committee, stating that he examined the Coal at Byrung Ponjie in various situations, within a circumference of four miles, and found in all the places an average of one foot of pure Coal and three feet of stiff black clay, with pieces of Coal intermixed. At one place the Coal appeared very good, but on being penetrated the inner parts turned out bad.*

* There can be no difference in the nature of the Coal composing the outer and inner portions of the same bed except such as arise from local causes not usually such as to destroy the value of the whole bed.

SUMMARY of the PROCEEDINGS of the Coal Committee from March till December, 1840. December 1840.

1. THE last meeting of the Committee took place on 6th April, when the secretary submitted the third Report of the Committee on the subject of Coal, which was approved, and ordered to be submitted to the Government.

2. Mr. Landers, a special assistant (to the Commissioner of Assam and the Political Agent of the Cossia Hills) for working Coal and iron mines, reports in a letter to Major Lister, that not one of the beds alluded to as Byrung Ponjie Coal, are workable, but sufficient details are not given by Mr. Landers to enable the Committee to satisfy itself on the subject.

3. Messrs. Fergusson Brothers, and Co., delivered, at the request of the Committee, 302 maunds of Mustuk Coal, on the part of Messrs. Inglis & Co., from a new mine near the foot of the Cherra Hills, to the following departments for trial:—The Mint, Cossipore Foundry, the River Steam Department. The Reports of Major Forbes, Mint Master, and Captain Wilson, Officiating Superintendent of Cossipore Foundry, on the quality of this Coal, are favourable, but that of Captain Johnston has not yet been received.

4. Major Lister writes, 28th April, he had then 10,000 maunds of Cherra Coal ready for dispatch, and at the same time transmits a memorandum exhibiting the heights and distances from the Cherra Coal bed to the plains, for the information of the Military Board. On the 3d of June, Major Lister commenced dispatching the Cherra Coal from the foot of the hills to Calcutta, and by the end of October had delivered upwards of 21,000 maunds. As this experiment was conducted by the advice of the Committee, it would be desirable that it should be made acquainted with the result both as to the out-turn of the Coal and the details of its expense.

5. Mr. Mills announced the dispatch of 150 maunds of Talcher or Cuttack Coal to the Committee for trial on the 21st of October last, the receipt of which may be daily expected.

6. In June last, the Committee received from Government Captain Wroughton's announcement of the discovery of several beds of Coal near the Village of Kotah, in Singrowly, which he hopes to be able to trace towards Burdee on the Soane river. The samples furnished of this Coal, consisting of five maunds, was reported by Major Forbes as inferior, not being burnable on a smith's forge,* but in the laboratory of the Honourable Company's Dispensary it was found to burn freely in a furnace with open bars below. Captain Wroughton has also forwarded specimens of the iron ores found in the vicinity of the Coal mines.

7. Dr. Spilsbury reports the existence of a fine Coal bed within nine miles of Jubulpore, from which the inhabitants of that station have been deriving fuel for some years past.

8. Captain Bogle reports the existence of several springs of petroleum and naphtha in Arracan, the latter particularly pure. Captain Bogle also furnished specimens of clay iron-stone, from which the Muggs manufacture their wrought iron, with samples of the metal in different stages of manufacture.

9. Captain Jenkins has announced the arrival of Mr. Landers in Assam, for the purpose of examining the Coal mines in that province, with a view to commencing to work them.

10. Reports on the above subjects, as well as on the information regarding the iron and other ores, communicated to the Committee, are now in course of preparation.

At a Meeting of the Coal Committee, held at the President's Quarters,
13 December 1840,

December 1840.

Present: C. W. Smith, Esq., President; Major Henderson, Captain Johnston, Captain Wilson, and the secretary.

1. In the proceedings of the Committee dated 9th March 1840, paragraph 5, it is stated that Major Lister in a letter dated 14th February, announces the discovery at Mustuk of a new bed of Coal, at an elevation of 1,500 or 2,000 feet, so convenient to water carriage as to allow of a cooly making five trips in a day, that Mr. G. Inglis is of opinion that the quality of the Coal is equal to that of Cherra, that he had already dispatched a boat load of this Coal to Calcutta with a view to ascertain its market price. The cargo was chiefly purchased by the Coal Committee from Messrs. Fergusson Brothers & Co., to whom it was consigned with the view to having it tried and reported on by the Controller of Steam Vessels,

Mustuk Coal.

* On further trial Major Forbes reports very favourably of the quality of this Coal. *Vide* paragraph 11, Proceedings for December 1840.

Vessels, the Mint Master, and the Superintendent of Cossipore Foundry. The Reports of the two latter have been received some time since, but have been kept back in expectation of receiving that of the Controller of Steam Vessels, which has not as yet reached the Committee.

2. Major Forbes reports, after a trial of four days in a 20-horse power engine, that 27 maunds of Mustuk Coal is equal to 28 of Burdwan.

3. Captain Wilson, Superintendent of Cossipore Foundry, reports the result of his trials to be in the Cossipore engines that nine maunds of the Mustuk Coal is equal to 12 of Burdwan, and that the Mustuk Coal yields 50 per cent. of coke. English Newcastle Coal yielding 65 per cent. The Burdwan Coal yields none. The quality of the coke from the Mustuk Coal Captain Wilson considers to be superior to that of Cherra.

4. Captain Johnston informed the meeting that his Report would, when received, be equally favourable; and that the trial of this Coal had made such a favourable impression on his mind that he on the strength of it invited Messrs. Inglis and Co. to send in tenders for its supply to any extent.

5. In reply Captain Johnston was informed through Messrs. Fergusson Brothers, & Co., that Mr. Inglis would not enter into a contract, but would send his Coal down to market. Since this reply has been received Captain Johnston has heard from Messrs. Fergusson Brothers & Co., that the conveyance of the Coal from the mines to water carriage* is too expensive to admit of Mr. Inglis prosecuting his intention.

6. Under these circumstances it was agreed in consequence of the superior quality of the Coal, to consult Major Lister as to the course which it would be most advisable to adopt with the view of ascertaining the extent to which this Coal occurs, and the difficulties to be overcome in bringing it into use with as little delay and uncertainty as possible.

7. Reports were then presented regarding the quality of Mergue Coals.

The sample of this Coal sent for trial was damaged, having been exposed to inundations long enough to encrust each fragment with a deposit of mud. The sample was consigned to Captain Johnston, by whom it was distributed for trial.

8. Major Forbes reports—"This Coal had a very dirty appearance, as if it had lain in dirty or muddy water; when broken it had a pitchy appearance. As this coal was chiefly very small, in using it I had to add a quantity of water, to prevent as much as possible its falling through the fire bars. When the water was applied a snapping noise was given out, not unlike slacking stone lime, but rather louder."

"On trial at the 14-horse engine it was found to burn free; the ash pit was particularly bright, and the flame of a white colour. The consumption, as compared with the best Burdwan, was 14 per cent. worse. The Coal appeared in burning to require the fire bars much nearer the boiler than the fireplaces of the Mint admit of, and which are particularly adapted for Burdwan Coal or for wood."

9. Captain Wilson briefly reports—"That the Mergue Coal is of a dirty appearance, and that, being small, a good deal of it fell through the grate of the furnace and was lost, and much of it mere slate. Compared to Burdwan it is inferior, 12 maunds of the latter being equal to 13½ maunds of Mergue Coal. On board a steamer 10 maunds of this Coal lasted three minutes less than one hour. Ranny Gunge, the best Burdwan Coal, lasting one hour and eight minutes."

10. Reports were then submitted from Major Forbes and the secretary on the quality of the Coal recently found by Captain Wroughton near the village of Kotah, in the district of Singrowly, about 50 miles from Chunar.

11. Major Forbes reports of this Coal as follows:

Coal, large rubble (muster only weighing 7.27½ maunds), and in good condition; form, rather slaty, and of a brown colour. When broken the fracture had the appearance of dull looking Kennell Coal.

On trial, at the twenty (20) horse engine it was found to burn freely with a strong flame. The steam was kept up well during the time it was used, and judging from this and from the circumstance that the engine was worked two hours and a quarter with it, at an expenditure of about three maunds per hour, the average consumption of the best Burdwan Coal, I think it may be inferred that this Coal is equal to the best Burdwan Coal.

12. The secretary reports as follows—A maund of the same Coal was tried in the laboratory of the Honourable Company's Dispensary, 22d September 1840, and was found

to

* The chief recommendation of the Mustuk bed is its proximity to water carriage. See Proc. 9th March, paragraph 4.

Mergue Coal.

Kotah Coal.

to burn very freely with a strong heat, leaving about 12½ seers of ashes. On analysis it affords the following results:

Specific gravity, 1.29.									
Inflammable matter	-	-	-	-	-	-	-	-	54
Carbon	-	-	-	-	-	-	-	-	32.2
Ash	-	-	-	-	-	-	-	-	13.8
									100.0

13. The following reports on trials of a Palamow Coal from mines at Dearee, were next submitted. It must be remarked, that the sample of this Coal from having been sent down in bags, and subjected to rough usage on the way probably, was reduced in a great measure to dust, as any Coal would be under the same circumstances. Dearee Coal.

14. Major Forbes reports that this Coal was not in good condition, a great portion being dust. The following is the result of trial at the Mint for the 20-horse engine, "it was found not to keep the steam up, and after repeated stopping, from the steam being exhausted, other Coal had to be substituted. The Coal is much inferior to the worst Burdwan Coal."

15. Major Forbes' second report on the same is as follows:

"The dust mentioned in the former report being rejected, on trial at the 20-horse engine, it was found to keep the steam well up, during the time it was used, namely, 2¾ hours, at a trifling excess of expenditure over the best Burdwan Coal."

16. The following is the result of analysis of a specimen of this Coal.

Specific gravity, 1.62.									
Inflammable matter	-	-	-	-	-	-	-	-	37.6
Carbon	-	-	-	-	-	-	-	-	58.1
Ash	-	-	-	-	-	-	-	-	4.3
									100.0

17. Captain Wilson having tried a sufficient sample of the above Coal, reports that it is equal to Burdwan Coal for steam purposes and burns freely. On board a steamer 10 maunds of this Coal was found to last one hour, Rannygunge or best Burdwan lasting an hour and eight minutes.

18. Mr. C. B. Taylor informed the Committee that persons employed by him have found a bed of Coal at Rajhara, in the Palamow district. The bed is said to be seven feet thick under a sandstone of 40 feet, both circumstances coinciding with what has been stated before regarding the Mirall Coals on the Amanath. Mr. Taylor presented a specimen of the Rajhara Coal as well as a few specimens from another bed, two miles distant, which the secretary has not yet had time to analyse.

19. Mr. Taylor states, on the authority of his native miners, now in Palamow, that he could supply good Coal to any extent from that quarter, and all that prevents him from at once commencing operations is the fear of the Coal being left on his hands. The Committee agree to authorise Mr. Taylor to deliver at the public expense 200 maunds of Rajhara Coal at Dinapore, and if good to recommend its use on the part of Government to a certain extent, and on such terms as might appear fair and reasonable.

At a special Meeting of the Coal Committee which took place at Government House, in the presence of the Governor General, 6th January 1841,

Special meeting,
January 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Captain Wilson, Members; Mr. McClelland, junior Member, and Secretary.

H. Inglis, Esq., Assistant to the Political Agent, Kasyah Hills, Visitor.

1. MR. INGLIS described the road from the Cherra Coal Mine to the brow of the hill at Mahadeo, a distance of three or four miles, as capable of being rendered fit for carts. At Mahadeo there is a steep precipice (800 feet deep, and 2,400 feet in its inclined length) on which a slide might probably be constructed.

2. From the base of this precipice on the new line of road proposed by Major Lister, the descent is moderate and uniform down to the river. A zigzag road, Mr. Inglis states, might be made down the precipice to allow cattle and even elephants to be used.

3. His Lordship informed the Committee that an engineer officer had been ordered to Cherra, Lieutenant Yule, with instructions to examine the means of improving the old and constructing a new road where necessary, as well as to ascertain the value and relative position of the various beds of Coal in the neighbourhood, to water carriage.

4. With regard to water carriage, Mr. H. Inglis stated, that the commissariat rates of 24 rupees per 100 maunds were now being paid by the Government for the delivery of Cherra Coal in Calcutta (not inclusive of demurrage) but he submitted a memorandum to show that, by constructing their own boats, 20 or 500 maunds each, the Government could deliver their Coal in Calcutta at 18 rupees per 100 maunds, being a saving of 6 rupees per 100 maunds.

5. Mr. Inglis stated that the boats would cost 500 rupees each, and with slight repairs would last 10 years, making three trips each year with 500 maunds of Coal, and although the boats would generally have to return empty, yet occasionally ordnance stores, &c. could be carried by them when, necessary as far to the eastward as Gowahatti, or to the northward as Bauleah, the limits on the great rivers to which it is safe to entrust Sylhet boatmen.

His Lordship saw no objection to this arrangement, particularly as it was stated that the Government had at one time a lime agency in the same quarter, with 50 boats of their own, to bring down the lime to the Presidency.

6. In reply to a question by his Lordship, Mr. Inglis considered Bauleah on the Ganges as equal in distance to Calcutta with regard to the delivery of Cherra Coal, and that its cost (from 8 to 9 annas per maund) would be the same at both.

7. His Lordship inquired of Captain Johnston the present rate at which Burdwan Coal is delivered at Beaulah or Surda, and finding that Cherra Coal could there be delivered at two or three annas per maund less, suggests that future supplies of Cherra Coal should be carried partly to Beaulah, with a view of supplying the river steamers at a cheaper rate than at present.

8. In consequence of the want of ground to land the Coal on its arrival at Calcutta, complaints have hitherto been frequent on the part of the Sylhet boatmen, arising partly out of their detention until ships were procured to receive their cargoes, and partly out of the mode of weighing, by which deficiencies were made to appear, and charged to the boatmen.

9. To remove such causes of complaint in future, Captain Johnston explained that a piece of ground has now been procured to receive the Coal immediately on its arrival, and that every facility will be afforded in future for the prompt discharge of the boats. It was also stated that Major Lister, or his assistant Mr. Inglis, might have a sircar in attendance on the part of the boatmen to see the Coal weighed, and that the boat people be not exposed to any unnecessary delay at the ghat.

10. It was decided, under these arrangements, that Major Lister should send down to Pandua, as much Cherra Coal as he can, and continue to dispatch it to Calcutta and Bauleah to the extent of tonnage he may be able to procure, provided the expense of delivery at either place does not exceed the rate at which the 20,000 maunds were delivered in Calcutta during the last season, including every expense.

11. Mr. Inglis having stated that the timber for the new boats could not be had before the next rains, it was ordered that boats should this year be hired and his Lordship hoped that in 1842 the Coal would be brought down in Government boats, as proposed by Mr. Inglis, which would lessen the price materially.

12. With regard to Mergue Coal, his Lordship remarked that its freight to Singapore and Penang is as high as from Calcutta to either of these places, viz., about 20 rupees per 100 maunds, and is desirous of knowing how this can be remedied, and what the nature of the coast trade may be on the southern parts of the Malay Peninsula. Vessels passing up the bay for cargoes in Calcutta calling at Mergue, would cause a detention of about four days, without including the delay of taking in the Coal, as for instance, 200 tons which might be shipped in from one to two days, according to the facilities afforded.

13. Letters were directed to be written to Arrakan and Cuttack, regarding the Coals of those districts. It was stated that the sample of Cuttack Coal, which Mr. Mills promised to forward to the Committee in November, had not arrived.

A letter was directed to be written by Major Forbes to Mr. J. Erskine, to know the rates at which he would undertake to supply the dépôts at Cutwa and Berhampore with Adji Coal.

14. It was stated that a letter had been written to Mr. J. Pontet, regarding the Rajmehal Coal, of which he supplied about two years since some very interesting information.

15. It was directed that Captain Smyth, executive superintendent of the Nuddyah rivers, should also be requested to repair to the sites of the Coal beds in that quarter, and if possible to make such inquiries on the spot as should determine the possibility of obtaining good Coal in sufficient quantity for supplying the steamers in that quarter.

16. It was directed that a letter should be addressed to Captain Wroughton, with a view of

of ascertaining the latest results of his operations, particularly with regard to the feasibility of establishing a Coal depôt for steamers in the neighbourhood of Chunar, from his discoveries in the Mirzapore Hills.

17. His Lordship then expressed his wish to see something done regarding metallic minerals, and particularly to see some results from the reduction of iron ores in the new furnace recently erected at the Mint. Major Forbes informed his Lordship that the furnace was not yet quite ready, but would soon be in a state to commence experiments.

18. A circular was directed to be sent to the different functionaries, regarding such ores as may be known to exist in their districts, and the native method and purpose of using them.

19. Letter to Colonel Cubbon should be written, requesting him to send samples of chrome ore from Mysore.

At a Meeting of the Coal Committee, held at the General Dispensary, Monday,
11th January 1841,

Special meeting,
January 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Members;
and the Secretary,

A LETTER from Major Carter to Major Henderson, member of the Committee, dated 13th October, was read, and that portion of it relative to the price of building boats particularly noticed—the amount for 500-maund boats being stated to be from 150 to 80 rupees per boat.

2. A paper on petroleum and other subjects connected with the objects of the Committee, was submitted by the secretary, as having been some time previously drawn up by him as the result of correspondence on the subject to which it relates, and circulated in the Committee, but not before entered on their proceedings. (*See Appendix.*)

3. Reports on the trial of different Coals alluded to in the Proceedings of the Committee for December 1840, and a second report on the Mergue Coal. An artificial fuel made up by Mr. Fisson, of coal-dust, mud, and lime, was found to keep up steam very well; but its cost is equal at least to that of Coal.

4. Ten maunds of Dearee Coal were next tried, and lasted an hour, producing in that time 1,180 revolutions.

This Coal, Captain Johnston concluded, would not of itself answer for internal navigation, where it is necessary to have spare steam at command to make head against the river currents; but he proposes to try it, mixed with English Coal. The Committee, as an amendment to this proposal, have suggested Cherra Coal instead of English for the mixed fuel, as it may be delivered at Bauleah as reasonably as in Calcutta. From Bauleah it might be transmitted up to Dinapore at a very small additional expense, and there mixed with the Dearee Coal; and if found to answer, two new Coals would at once be brought into use, doubtless at a considerable saving upon the present rates of Burdwan Coal in the higher depôts on the Ganges. In all the Coals yet discovered on the western side of the Hooghly (the Nerbudda Coals only excepted), the bitumen occurs in small proportion compared with the carbon; while in Cherra, and all the Coals hitherto found to the eastward, the bituminous property predominates. Hence the former Coals burn without becoming soft and plastic, while the latter melt, and all the fragments unite together and cake.

It is therefore probable that a mixture of Cherra Coal with that of the less bituminous beds of Palamow would afford cheap and good supplies for inland navigation.

5. The results of Captain Johnston's trials of Dearee and Mergue Coals are valuable in connexion with the trials and remarks of Major Forbes and Captain Wilson on the same subjects, recorded on our proceedings for last month.

6. A letter from Captain Jenkins was read, giving cover to a letter from Mr. Landers, his special assistant for mining, to Lieutenant Brodie, principal assistant.

7. The following is a copy of the letter alluded to:—

“To Lieutenant *T. Brodie*, Principal Assistant Commissioner of Assam.

“Sir,

“Am sorry to inform you, that sickness has obliged me to return to Seeksagur, consequently my stay in the Naga Hills was but short; but, during that time, I visited what was pointed out to me as being two distinct stratas of Coal lying under each other, both situated halfway up the Namsany Purbut. The upper strata is six feet high, clay forming the roof and bed; it dips due south at angle of 40 degrees, the valley at that of 30 degrees; the Coal thereby burying itself prevented me from tracing it beyond 100 yards; but, from what I saw of it, am certain that it could be easily worked at a very trifling expense. The present road,

although easy, is long, but a footpath could be cut through the jungle, and would reduce the road to one mile and a-half.

"The under or supposed strata turned out to be nothing; it was merely the Coal worked from the upper strata, and formed into something like an outburst of a new Coal vein.

"Another Coal measure was pointed out to me on the very top of the Namsany Purbut, bearing due south from the above, but too far inland to be of any present use; but as to its probable extent, am sorry I cannot give you any information, as my sickness prevented me from visiting it.

"I have much pleasure in informing you, that I have found pieces of limestone all along the bed of the Deko river above the first rapid; also small pieces in a mountain stream immediately below the Coal strata mentioned in paragraph 1st. From the position in which I found the specimen below the Coal, am certain the main rock cannot be far distant. I shall forward the specimen to Captain Jenkins.

"With your permission, I shall proceed to Jeypore first, as soon as Mr. Furnell permits me, and finish the survey around Jeypore, Borehauth, and return to the Naga Hills by Teeroogong; I shall then have time to examine the Namsang Purbut minutely.

"I have, &c.

(signed) "A. H. Landers.

"Seesbazar, 29 November 1840.

"Special Assistant to Commissioner of Assam."

Probably the two Coal beds alluded to by Mr. Landers are those brought to notice near Joorhath, about two years ago, by Captain Jenkins.

8. Read a note by his Lordship the Governor General, appended to the draft of the proceedings of the last meeting, earnestly requesting the Committee to prepare for the public a statement of all the facts that have come before it, and the researches now in progress; also to lay down a series of stations for Coal depôts on the Burhampooter, stating the nearest points from which they may be supplied, as well as a similar series of depôts, &c., for steam communication with Moulmein, Noacolly, Dacca or Sylhet, Ramree, Amherst, Mergue, &c.

9. With regard to the Burhampooter, the secretary was directed to communicate with Captain Jenkins, and to suggest that Mr. Landers might be employed in raising Coal for the supply of depôts in Assam, from some of the most convenient Coal beds in their vicinity, rather as an experiment in the first instance; and the secretary was requested to prepare an abstract of the proceedings of the Committee, to be published together with the Reports, to the extent of 250 copies, for gratuitous circulation to the correspondents of the Committee.

10. A letter from Mr. Turner on making charcoal was read, together with a letter from Lieutenant Hutchinson regarding the operations carried on in the Mergue Coal-mine; also extracts of a letter from Captain Bogle.

11. Captain Bogle's letter was accompanied with a sample of good Coal from a place situated only four or five miles inland from the town of Ramree; unfortunately, the intermediate country between the coast and the coal is hilly and difficult, but Captain Bogle hopes that the measures adopted by Captain Williams will lead to the discovery of equally good beds in some more convenient situation.

12. A Report from Major Forbes on the quality of a sample of Coal received from Messrs. Gilmore and Co. was then read, but the owners decline to say where the Coal, which appears to be very superior, has been found.

February 1841.

At a Meeting of the Coal Committee, held at the Honourable Company's Dispensary,
Monday, 8th February 1841,

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; J. McClelland, Secretary.

Mixture of Cherra
and Palamow Coal.

1. WITH a view of submitting to extensive and decisive experiment the fitness for purposes of internal steam navigation of a mixture of equal parts of Palamow and Cherra Poonjee Coals, it was agreed that Major Sage should be requested to send down to Calcutta at least 300 maunds of best Dearee Coal, received from Mr. Ravenshaw, and which might be delivered at a very reasonable rate compared with the present prices at Dinapore. This Coal is too carbonaceous, according to the result of experiments in ordinary furnaces, to keep up steam of itself, but when mixed with an equal proportion of Cherra Poonjee Coal, it may then answer all the purposes of a useful fuel; and as Cherra Poonjee Coal itself may be delivered as high up the Ganges as Bauleah, at a considerable reduction on the present prices of Burdwan Coal, it may still be carried higher up to Dinapore at a proportionably reduced rate, where its admixture with a still cheaper Coal might render its use very important.

With a view to the great interest of the subject, it was decided by the Committee that equal portions

portions of the Palamow Coal, on its arrival, should be distributed to the Mint, Cossipore Foundry, and the Steam Department, together with equal portions of Cherra Coal, and that the heads of these departments be requested to try the two Coals mixed together, and furnish the Coal Committee with separate reports of the result.

2. It has recently been discovered that 2,835 maunds of Adji Coal, delivered by Mr. James Erskine of Panamooky, on account of the Coal Committee at Cutwa in 1837, although condemned at the time as unfit for use, has been since quietly used on board the steamers by the contractor, for Burdwan Coal.

The contractor should be called upon to refund to the Committee at least the sum advanced for this Coal, at four annas per maund, its actual cost (Rs. 708. 12. 0.); and as he charged it to the Government at 9 annas 4 pies, the price of Burdwan Coal at the time, he would still have a clear profit of Rs. 949. 12. The mistake, considered as an experiment, is very favourable to the Adji Coal.

3. The Secretary will write to Captain Johnston, requesting of him to recover and transmit to the Committee the sum paid by the Committee for the Coal in question.

4. Read a letter from Mr. C. B. Taylor, offering to supply a sample of Rajhara Coal for trial, provided the Committee will agree to pay the expense, which Mr. Taylor seems to think will be considerable. The Committee desired Mr. Taylor to be informed that they had supposed the Coal alluded to to have been more conveniently situated than would now appear to be the case. Having already agreed to pay any fair reasonable demand (under 12 annas per maund) for a sample of 200 maunds for trial, the Committee decline to enter into any definite engagements on the subject.

5. Specimens of Coal received from Assam, supposed to be from the west bank of the Dikoo, but without particulars being communicated, were submitted to the Committee; also a letter from Captain Jenkins, enclosing one from Lieutenant Brodie, stating that the Coal alluded to in Mr. Landers' letter (*vide* paragraph 7, Proceedings for January 1841) is the same as that before found by Mr. Strong.

6. Major Forbes informed the Committee that he would supply the result of a trial of Oram's artificial fuel; and the President presented two specimens, with a memorandum from Mr. Fisson regarding a similar invention of artificial fuel from Slack Coal.

7. The secretary was requested to write to Captain Jenkins and Major Lister for the result of their experiments on the manufacture of fuel from charcoal and petroleum, and also to Captain Bogle for information as to the existence of limestone at Arracan.

8. A letter was read from Mr. Pontet, stating that he expects soon to be able to communicate further information regarding the existence of Coal at Beerbhoom.

9. An interesting communication from Lieutenant Ouchterlony was read, in which he proposed to transfer to the Government a Cornish miner and mining implements. The Committee have strongly recommended to Government that the miner be employed, and such part of the implements purchased as may be considered indispensable.

10. An official correspondence regarding the discovery of Coal at Port Natal, in South Africa, was received from the Government, originating in the publication of "Notes on South African Affairs, by Mr. Boyce," and the "Notices of the Cape and South Africa," in the "United Service Journal," January 1840, by Major Charters, R. A. The following extract is from Mr. Boyce's Notes: "Coal is found in the Sand river, between the Great and the Little Ingola river; and at the Blue Krans river (Natal country) we dug up some near the road between the Ingolas, of which I brought home with me a small quantity. This was taken from near the surface, and proves on trial to be Coal of second or third rate quality. We also found a small piece of Coal on the shore, about a mile east of the entrance of the Bay of Natal, but this might have been washed on shore from some vessel; however, there is no doubt but the country in the vicinity of Natal produces abundance of this valuable article." The following is from Major Charters' notice: "I have seen Coal of an excellent quality (not the recent Coal, which so often deceives the inexperienced, but that belonging to the true Coal formation) which had been brought from the second river on the western slopes of the Quath Lamba."

Coal at Port Natal.

11. Captain Sir J. Alexander, who brings these statements to the notice of Government, adds: "I have just seen Major Charters, and he informs me that the Coal which he saw at Natal was shown him by the Rev. Mr. Archbell, a very respectable Wesleyan missionary, who himself found it *in situ* at the said river before mentioned; the emigrant Bóoro also told the Major that they used it constantly in their forges, and that the road to it from the port is good, and extends through very fertile country; the Coal was as good as the best English Coal, and not lignite or wood Coal."

12. Captain Johnston informed the meeting that he wished for the attendance of the Committee on board a steam-vessel on Saturday next, to try a Coal submitted to the Government for sale by Mr. Hornfray, the locality of which the owner is desirous of keeping a secret. It was agreed that the Committee meet for the inspection of the above Coal on Saturday next, the 13th February.

TRIAL of COALS on board the "Enterprise" Steamer, on Saturday, 13 February 1841.

Present :—C. W. Smith, Esq., E. A. Blundell, Esq., Captain Johnston, and Mr. M'Clelland.

1. Tenasserim Coal.—The fires being low, and steam down, this Coal introduced, and in five minutes the steam-gauge rose to 2 lbs., the engines, at full work, making 34 revolutions; $3\frac{1}{2}$ maunds lasted 45 minutes, and left 16 per cent. of ashes.

2. Mr. Homfray's Coal.—This Coal was tried at a quarter before 12 o'clock, and the trial persisted in till half-past 12, being three-quarters of an hour, during which time the engines were almost motionless. The ashes of 1 maund and $31\frac{1}{2}$ seers of the Coal which was used amounted to 15 per cent.

3. Ramree Coal, Koeng Dyeng.—Eight minutes before one o'clock, this Coal was added to the fire; the steam immediately after rose, and the engines worked at 34 revolutions, steam gauge indicating the highest pressure, and still steam blowing off, when it was thought necessary to become more sparing of the fuel; thus three maunds lasted 58 minutes, the engines making from 30 to 35 revolutions. The ashes were then collected, and found to weigh only $3\frac{1}{2}$ seers, or about $1\frac{1}{4}$ per cent.

4. Second variety of Ramree, or Hoong Coal.—Three maunds of this Coal lasted 40 minutes, and left about 15 per cent. of ashes; steam-gauge low, and the engines below their work, and stopping occasionally for want of steam.

5. Kingtellie Coal, from Arracan.—This was a heavy, earthy Coal, which was found incapable of keeping up steam, while it left half its weight of ashes.

6. Cherra Coal was then tried, but the trial was not attended to; three maunds left $12\frac{1}{2}$ seers of ashes.

The following is a statement of the different Coals tried, in the order of their respective value :—

1. Ramree Coal, Koeng Dyeng	-	-	-	-	-	Note. — These results might be different in boilers with a greater draft than that of the boilers of the "Enterprise."
2. Cherra Poonjée	-	-	-	-	-	
3. Tenasserim	-	-	-	-	-	
4. Second variety of Ramree Coal	-	-	-	-	-	
5. Mr. Homfray's Coal, locality not stated	-	-	-	-	-	
6. Cap Island (Arracan) Coal	-	-	-	-	-	

March 1841.

At a Meeting of the Coal Committee on the 8th March 1841,

Present :—C. W. Smith, Esq., President; J. M'Clelland, Esq., Junior Member, and Secretary,

LETTERS were read from Captain Bogle, announcing the dispatch to Captain Johnston of 90 or 100 maunds of the Kingtellie Coal, situated on the seacoast, about 20 miles west of Sandoway, for trial. This proved to be a heavy, earthy Coal, and yielded half its weight of ashes. This Coal has been recently re-discovered, but, we regret to say, without any additional information regarding the natural or geological history of the bed, or topography of the place, to prevent every new-comer at Kingtellie announcing the existence of this Coal as a new fact, and, finding it not to be so, giving up all further interest in the matter.

Koeng Dyeng.

2. A sample consisting of Coal from the western side of Ramree island, at a place called Koeng Dyeng. This Coal is found four miles from the western beach, and only about one mile from a river navigable for small boats from its mouth to the above distance from the hill in which the Coal is found; three maunds of this Coal, tried on board the "Enterprise" steam-vessel, 13th February 1841, in the presence of Captain Johnston and the president and the secretary of the Coal Committee, proved superior even to Cherra Poonjee Coal.

3. A second variety of Ramree Coal, from a place called Hoong; was also tried on board the "Enterprise" steamer, and found to be a very fair Coal (*vide* Report 13th February); the locality is described to be a few miles south of the town of Ramree (*vide* Report on Arracan Coal, 1840); but Captain Williams now announces the existence of Coal south as well as north of Hoong, from which he has been requested to send 1,000 maunds to Kyouk Phyu for dispatch to Calcutta for trial, also 1,000 maunds from Muggee or Paget Island.

4. Captain Williams also states, that the Coal darogah has produced samples of Coal from Aeng, one of the divisions of Kyouk Keung.

5. A sample of Coal, together with the following account of it, has been received from Dr. Hinton :—"At about three miles to the southward of the northernmost part of the island of

of Ramree are two islands, connected with each other and the mainland by ridges of sandstone rock visible at low-water; the largest and outermost is called Saddle Island, the other was named Cap Island; both of them are chiefly composed of sandstone of different degrees of density and colour, with many shells, fossil plants, and branches of trees imbedded in it. On Cap Island, which is about a mile in circumference, a bed of Coal lying in slate-clay, and pointing nearly due west, so as to impinge upon the Saddle Island is readily distinguished, and in the opposite direction points with a slight curve towards the mainland. Here Colonel Hervey found the sample of Coal forwarded by Dr. Hinton, and pointed out its value to the natives; the bed appears to be situated below the influence of the tides, and is probably that which was discovered 10 years since by Lieutenant Foley, opposite to Kyouk Phyu Harbour, and found to be too sulphureous for use. Cap Island Coal.

6. With regard to the 9th paragraph of the Committee's Proceedings for February 1841, a letter from Government (No. 162, dated Fort William, 3d March 1841) was received, directing the secretary of the Coal Committee to enter into communication with Lieutenant Ouchterlony regarding the valuation and purchase of the mining implements therein referred to, and also informing the Committee, that the person brought by Lieutenant Ouchterlony to India as a miner, will be employed on the part of Government at Ramree or Sandoway.

A sample, consisting of 150 maunds of Cuttack Coal, being announced as received at the Mint, it was suggested that measures should be as soon as possible adopted for its trial, and that receipts should invariably be taken from the Mint, Cossipore, and Steam Departments, to which large samples of new Coals may in future be transferred for trial, to enable the Committee to know what samples they have on hand for trial, and how to account for them.

7. Read a letter from Dr. Cantor, accompanied with a specimen of Coal from a mine, situated within the walls of the city of Canton. Large supplies of this Coal are stated by Dr. Cantor to be used by the Chinese, although the English prefer Newcastle Coals whenever such are attainable. The existence of abundance of Coal in China has been recorded, Dr. Cantor observes, by Marco Polo, Du Halde, Abel, and lately by Mr. Davies. Canton Coal.

8. Read a letter from Captain Jenkins, stating that he has requested Mr. Landers to forward information of the result of his operations in Assam, and in future to supply quarterly reports of his proceedings for the information of Government. The Committee think that monthly reports should be furnished by Mr. Landers to the local authorities in Assam, in addition to the quarterly reports required by Captain Jenkins for the information of the Committee and of Government.

9. Read a letter from E. W. Blundell, Esq., Commissioner of the Tenasserim Provinces, announcing the discovery of Coal on our northern frontier within five days' journey of Moulmein. Mr. Blundell at the same time presented specimens of the mineral, which appears to be similar to that found at Mergue. The spot where the Coal occurs has not as yet been visited by Europeans. Mr. Blundell also presented specimens of iron ore from the same quarter.

10. A letter from Colonel Cubbon, announcing the dispatch of specimens of chromate of iron.

11. And from Mr. Erskine, proposing to supply 10,000 maunds of Adji Coal, next rains, at 6 annas per maund, delivered at Cutwa, and stating receipts for the delivery of 2,835 maunds of Adji Coal at Cutwa in 1837, on account of the Coal Committee (*vide* Proceedings, March 1841, paragraph 3), have been forwarded to Captain Johnston, to enable him to recover the value of the same.

At a Meeting of the Coal Committee, held 5th April 1841,

April 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; and Mr. J. McClelland, Secretary,

A COMMUNICATION from Captain Jenkins, announcing the discovery of extensive beds of Coal close to the extreme end of the Carbari Hills, near the Burhempooter, at the exit of the river from Assam: a small sample of doubtful quality was first sent to Captain Jenkins, which led to the discovery of highly bituminous and good Coal, of which samples may shortly be expected.

The secretary was directed to present the thanks of the Committee to Captain Jenkins for this very interesting communication, and to inform him that the Committee is anxiously awaiting further particulars as well as samples of the Coal, and could wish to receive a sketch of the locations.

2. Communications were received from Assistant Surgeons Hinton and Spry regarding the Coal alluded to in the 5th paragraph of the Proceedings of the Committee for March 1841, and as might be expected from the account there given of Cap Island Coal, the communications in question render its use very doubtful in consequence of the very thin detached beds

beds in which it occurs at the surface, and the difficulties of any attempts to reach a workable bed, owing to the highest crops being scarcely raised above the level of the tides. Excavations in search of Coal were in progress on Ramree opposite to Cap Island, where indications of Coal were observed, but without any immediate prospect of success. As arrangements have recently been made to send a miner to Arracan, the Committee recommend that a sum, not exceeding 500 rupees, should be placed at the disposal of the Commissioner, Captain Bogle, to meet the expense of his commencing operations at Koeng Dyeng, on the western coast of Ramree, where the sample of Coal marked x, alluded to in Captain Bogle's letter to the controller of steam-vessels, was found (*vide* Proceedings of Committee, 8th March 1841, paragraph 2), and which (*vide* Report of Experiments, 13th February 1841, paragraph 3) proved to be of superior quality.

In consequence of the confusion arising from the practice of forwarding samples of Coal from various districts in Arracan, by ship conveyance, with paper tickets, which are lost or obliterated, the Committee will recommend wooden labels to be tied to each sample.

With regard to paragraphs 2 and 3 of Proceedings, 8th February 1841, Mr. Erskine writes that he has forwarded to Captain Johnston receipts of the Coal agents in charge of the depôts at Cutwa for 3,835 maunds of Adji Coal, delivered to them on account of the Coal Committee in 1837. Captain Johnston informed the Committee that he has no doubt the Coal in question was used by the contractors on board the steamers, but that it will be difficult now to obtain an account of it, though he will make every endeavour so to do. Mr. Erskine will, during the ensuing rains, be ready to supply Adji Coal at Cutwa at six annas per maund, higher stations at an advance, according to the boat-hire. A sample, consisting of 10 maunds, has been forwarded to Captain Johnston for trial. Major Forbes suggested that samples of less than 40 maunds are unsatisfactory, and it was agreed to request Mr. Erskine to send 200 maunds to the Cossipore Foundry, from whence the proper quantities for trial are to be at once issued to the several departments, 30 maunds to each.

Adji Coal.

4. With regard to the sample of Cuttack Coal alluded to in the 7th paragraph of the Proceedings, March 8th, it was arranged that 30 maunds should be issued for trial to each of the following establishments:—

The Mint.
The Steam Department.
Cossipore Foundry.
General Dispensary.

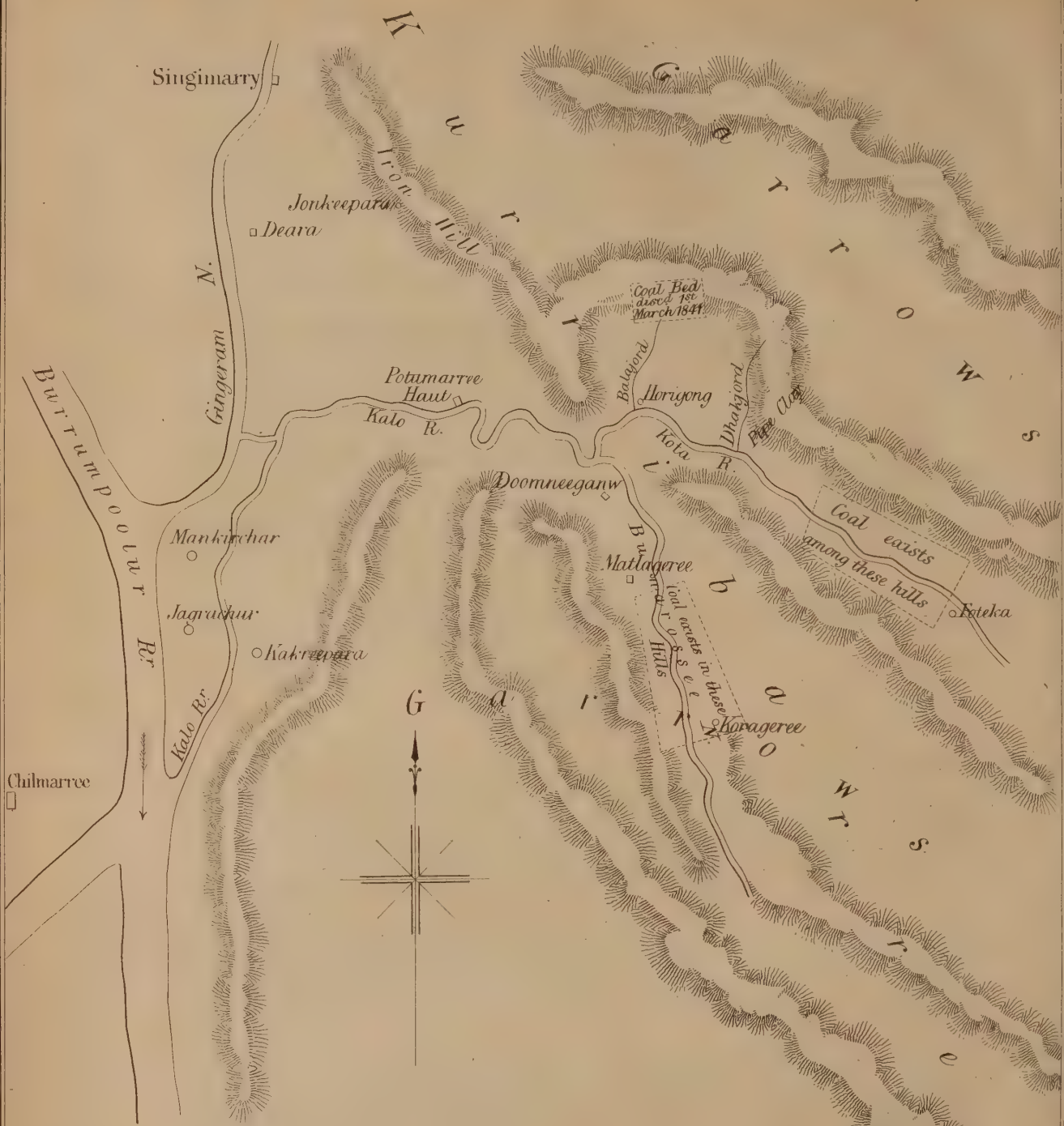
5. Read a memorandum from Captain Johnston, to the effect that Major Lister had dispatched 4,000 maunds of Cherra Coal to Dinapore, at Rs. 63. 12. per 100 maunds. This is particularly important, as exhibiting not only the rate at which the Cherra Coal may be delivered at Dinapore, but that the Sylhet boatmen have no objection, as has been alleged, to going higher up the Ganges than Bauleah; and although the rate is high, still it is less than that now paid at Dinapore for Burdwan Coal; and if the mixture of Cherra with the best description of Palamow and Soane Coal will answer for steam, a cheap fuel will thus become available.

6. Read a letter from Mr. James Pontet, forwarding a sketch-map of the situation and extent of the beds of Coal near Doooragepore, on the Burmany river, west of Moorshedabad, and at the same time remarking that want of time and experience prevents his doing more this season, and that he is more than ever convinced that it would be worth while to send a person who has been in the habit of tracing Coal beds, in order to examine the district.

7. Major Forbes read a Report on preliminary experiments performed at the Mint on Adji iron ore, with a view of ascertaining the proper proportion of ore and limestone for experiments, on a large scale, in the new furnace erected for the purpose at the Mint. The ores were of an inferior description, having been collected probably by native iron-workers, who selected the best for their own use; it yielded only from 25 to 30 per cent. of malleable iron. From some peculiarity of the red ironstones of Bengal, a difficulty is experienced in separating the metal from the slag, which Major Forbes states has not yet been overcome, so as to obtain, as is desired, cast-iron. It is, however, his intention to extend and modify the experiments with this view.

Iron ore.

8. A letter was next read from Colonel Cubbon, Commissioner of Coorg (dated Bangalore, 26th February 1841), announcing the dispatch of specimens of iron ores from Mysore, consisting of three specimens of chromate of iron found in the Mysore, and two from a mine in the adjoining zillah of Salem, together with other samples of Mysore iron ores, as well as several samples of Mysore steel-wire, the finer sorts of which have a high reputation in the South of India. The secretary was directed to thank Colonel Cubbon for his obliging communication and the specimens, as well as for his offer to forward further information and specimens, should the researches still in progress in Mysore bring anything of importance to light on this subject.



Coal was found at Dhakjora & Doomneeganw in the beds of the River Kalo and Bunnarosse which proves its existence among the hills through which it passes.

The Coal Bed is situated 3 or 4 miles N. of Horigong near the Balogora.

Boats of 50 or 60 m^{ds} go up the Kalo R. all the year round to Potumarre Haut. But in the Rains, boats of 400 or 500 m^{ds} can go to Horigong or Dhakjora.

Scale.
0 1 2 3 4 5 6 Miles

6th April 1844.

(Sig^d) J. Bedford
Ass^t Rev^d Surveyor.

At a Meeting of the Coal Committee held on the 3d May 1841,

March 1841.

Present:—C. W. Smith, Esq., Major Forbes, and J. M'Clelland, Secretary.

READ a Report from Major Forbes on the trial of a sample of Cuttack Coal received from Mr. Mills, Commissioner of that province. The Coal is of a dull slaty appearance, and although it burns and keeps up steam, yet it does so with difficulty, and on the whole appears to be a very unfavourable sample.

REPORT ON CUTTACK (or TALCHER) COAL sent to the Coal Committee by Mr. Commissioner Mills, received in the Mint on the 27th of February and the 4th of March 1841.

THIRTY maunds were submitted to trial at the Mint 20-horse-power steam-engine, when it was found that about six maunds an hour were required to keep up the steam, and which it only did, as regarded firing, with considerable difficulty.

The consumption of the best Burdwan Coal, in an hour, is three maunds and five seers. It thus appears that, practically, the value of the Coal experimented on is less than half that of Burdwan Coal.

The 30 maunds of Cuttack Coal alluded to contained 5 maunds of broken Coal or dust, which did not admit of being burned in the furnace. On fracture it appeared slaty, and generally of a description not well adapted for furnace-work, or for keeping up steam.

(Signed) W. N. Forbes, Mint Master.

The appearance and quality of this sample fall far short of what the Committee had been prepared to expect; it is hoped, however, that Mr. Mills will continue his inquiries; and as a guide to those employed under him, the Committee have desired some specimens of good English and Native Coal to be sent to Cuttack.

2. Read a letter from Mr. Sconce, of Chittagong, accompanied with a sample of good coal, said to have been found in the bed of a river called Femy, where it is said to exist in large quantity. Mr. Sconce does not, however, place much faith in his informants, who may have no object but merely to recommend themselves to favour, or to secure the rewards he has offered for the discovery of Coal in his district. The existence of Coal in the Tipperah Hills has always appeared probable to the Committee, and this idea has been particularly strengthened by the recent discovery of a succession of Coal tracts all along the coast from Arracan to Mergue; the probability is now that it will be found at intervals from Arracan to Sylhet, and the Tipperah Hills are a very likely place to find it. Mr. Sconce mentions the existence of salt springs in those hills, which is so far an indication of Coal that it affords good evidence of the presence of rocks which overlie the Coal formation.

3. Letters were then read from Captain Jenkins, Commissioner of Assam, accompanied with specimens of Coal from Mr. James Bedford, Revenue Surveyor, consisting of fragments of a dull earthy Coal from the Caribari Hills, alluded to in the 1st paragraph of the Proceedings for April 1841. The specimens were evidently picked up from the surface, and from long exposure had lost the freshness of good Coal; the secretary was directed to prepare an analysis of them, and write to Captain Jenkins to secure pottahs of the lands in which they are found. These communications were accompanied with a map of the district over which the Kalo river passes. The Kalo enters the Bramaputra opposite to the village of Chilmaree, and is navigable for 50-maund boats all the year to a place called Patumaree, about 18 miles from its mouth, and during the rains for 400 or 500 maunds boats to Hurigong, six miles still higher.

Caribari Coal, near Chilmaree.

Hurigong is therefore about 24 miles from the Bramaputra at Chilmaree, the whole of which distance is navigable during the rains to boats of 400 or 500 maunds burden. On the north side of this village there is a Coal bed, three or four miles distant, which was discovered by Mr. James Bedford. On the east, about 10 miles higher up the Kalo, there is also Coal, and also in a third situation, about six miles south of Hurigong, on the River Bunarasse, a branch of the Kalo. The specimens sent to the Committee have been taken from the first-mentioned or Balajora bed.

4. Read a letter from Major Lister, stating that 20,000 maunds of Cherra Coal are ready, at the foot of the hills, to be dispatched as soon as the rivers rise, and as much more lying ready at the mines. It had been suggested, that with the view of giving the extent of the Mustuck mines a fair trial, they should be opened at the risk of Government; but Major Lister writes that Mr. Inglis, of Chhattack, has commenced working this mine, and intends to carry on operations on a large scale.

Sylhet Coal.

5. Read a letter from Captain Smyth, Engineers, Superintendent of the Nuddea Rivers, stating that the season is now too far advanced to allow of his visiting the Coal beds at Doobradgepore, but that he has persons out making inquiries, by which his own movements will afterwards be regulated. Resolved, that a copy of Captain Smyth's letter be transmitted to the Secretary to Government, for the information of the Right Honourable the Governor General.

6. Read a letter from Lieutenant Ouchterlony, Madras Engineers, dated 24th April 1841, stating that, in consequence of the want of communication with the coast, the miner and his implements have not been forwarded to Arracan, but hoped to be able to send him on the "Enterprise" steamer to Calcutta.

7. Read a memorandum from Captain Johnston, to the effect that Mr. C. B. Taylor is disappointed that the Coal Committee have not authorised him to forward 200 maunds of the Palamow Coal (referred to in 4th paragraph, Proceedings 8th February), to Dinapore, at the public expense. The secretary was requested to inform Mr. Taylor that he is authorised to send a sample, consisting of 200 maunds, of the Coal he proposes to supply to Major Sage at Dinapore, and that the Committee will recommend the expense to be granted to Mr. Taylor, provided it be not in excess of 8 annas per maund to Dinapore, all charges included.

8. A letter from Mr. Wilkinson (in reply to the Committee's Circular of 25th March 1841), on the minerals of Nagpore Territory, was submitted to the Committee, and the secretary directed to return the thanks of the Committee to Mr. Wilkinson.

9. It was stated that sulphate of iron, an article of much use and importance in the arts as a substitute for sulphuric acid in many chemical manufactures, is sold in the bazaar at 8 rupees per maund, although it may be produced at a nominal expense from refuse or pyritous Coal; Coal particularly suited to the purpose is abundant both in Sylhet and Arracan. As the consumption of sulphate of iron would become considerable if the price were moderate, the secretary is directed to write to Captain Bogle and Major Lister on this subject.

True Abstracts,

(signed) J. M'Clelland,

Secretary to the Coal Committee.

Calcutta, May 1841.

TABLE of INDIAN COALS Analysed in the Laboratory of the Honourable Company's Dispensary, from January 1839 to August 1840, in continuation of Prinsep's Table.—Journal Asiatic Society, 1838, p. 177.

No.	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 Parts.			FROM WHOM RECEIVED.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
60	Moulmein - - -	Cannel Coal - - -	1.177	42.8	54.6	2.6	Mr. Blundell, 7th May 1839.
61	Hoong, south of Ramree, six miles.	Caking Coal - - -	1.32	36.	49.	15.	Captain Bogle, 1st June 1839.
62	Tyroo Ghat, Assam -	Caking Coal - - -	1.3	40.	55.	5.	Captain Jenkins, 3d August 1839.
63	Palamow Mirall - -	Slate Coal - - -	1.26	44.	50.	6.	Mr. Tytler, Steam Department.
64	Palamow - - -	Slaty Crop Coal - -	1.48	32.	58.	10.	Mr. Tytler, specimen marked Palamow.
65	Palamow, "Singra" -	Slaty Crop Coal - -	1.2	25.	63.*	12.	Mr. Tytler, specimen marked Palamow, 10th September 1839.
66	Mergue - - -	Caking Coal, excellent -	1.27	55.	40.	5.	Mr. Blundell's Assistant, Lieutenant Hutchinson, 27th August 1839.
67	Byrung Ponjie, Sylhet -	Caking Coal, excellent -	1.3	34.	64.5	1.5	Major Lister, 4th September 1839.
68	Byrung Ponjie, Sylhet (variety).	Slaty, inferior - - -	1.4	25.	29.	46.	Major Lister, 4th September 1839.
69	Byrung Ponjie, Sylhet (variety).	Surface Coal - - -	-	30.	50.	20.	Major Lister, 4th September 1839.
70	Byrung Ponjie, Sylhet (a different sample).	Caking Coal - - -	1.3	51.	42.	7.	Major Lister, 2nd January 1840.
71	Chuppra, on the Soane -	Slate Coal, mixed - -	1.5	32.	57.5	10.5	Mr. Ravenshaw, January 1840.
72	Borneo - - -	Slate Coal, excellent -	1.27	59.6	34.	6.4	Captain Johnston, 18th April 1840.
73	Boorhath, Assam - -	Caking Coal, excellent -	1.2	45.	52.7	2.3	Lieutenant Strong, 24th June 1840.
74	Boorhath, Assam (another bed.)	Cannel Coal, excellent -	1.28	44.	48.	8.	Lieutenant Strong, 24th June 1840.
75	Cheduba, Arracan - -	Cannel Coal, inferior -	1.30	46.8	41.	12.	Captain Bogle, July 1840.
76	Khota, Singrowly - -	Middling - - -	1.29	54.	32.2	13.8	Captain Wroughton, 22d September 1840.
77	Jubbulpore - - -	Excellent - - -	1.49	50.	47.1	2.9	Dr. Spilsbury.
78	Near Dearee, the Soane -	Middling - - -	1.42	37.6	58.1	4.3	Mr. Ravenshaw, 24th November 1840.
79	Qulimany (Cape) - -	Surface Coal - - -	1.6	23.2	40.16	36.6	From South Africa (Mozambique).
80	Tavoy River - - -	Cannel Coal - - -	1.72	62.	28.26	9.74	Mr. Blundell, February 1841.
81	Chittagong, or Tipperah Hills.	Good Slaty Coal - - -	1.375	64.6	24.4	11.	Mr. Sconce, April 1841.
82	Petchelee Gulf - - -	Anthracite - - -	1.71	20.	74.	6.	Received through Captain Johnston, April 1841.
83	Doobradgepore - - -	Slaty Coal - - -	1.4	42.	38.	20.	Mr. James Pontet, May 1841.

J. M'Clelland, Secretary Coal Committee.

* The large proportion of carbon in this Coal would render it an excellent fuel if mixed with Cherra Coal, in which bitumen preponderates, while both might be had more reasonably at Dinapore than Burdwan Coal.

COAL COMMITTEE in Account with GOVERNMENT—continued.

Dr.	Cr.		
COAL COMMITTEE in Account with GOVERNMENT—continued.			
	Rs. a. p.	Rs. a. p.	Rs. a. p.
1839, May	To A writer's wages from 23d October to 30th November 1840, being 1 month 8 days, at 16 rupees per mensem -	26 - -	
	" Two writers' wages, from 1st December to January 1841, being 2 months, at 16 rupees each -	64 - -	
	" A peon's wages, from January to June 1839, being 6 months, at 5 rupees per mensem -	30 - -	
	" A peon's wages from July 1839 to January 1841, being 1 year 7 months, at 5 rupees -	95 - -	
	" Extra peon, for 2 days of April 1840, at 5 rupees per mensem -	1 5 3	
	" Extra peon, for 4 days of July 1840, at 3 annas per day -	12 - -	
	" Painter's wages, from June 1840 to January 1841, being 8 months, at 20 rupees per mensem -	160 - -	
	" Postage from November 1839 to January 1841 -	40 4 6	
	" Petty charges from February 1839 to January 1841 -	18 12 6	
	" Stationery from January 1839 to January 1841 -	62 6 6	
	" Four cabinets for the Coal Committee, at Rs. 61. 8. each -	246 - -	
	" A table and almira, at 24 rupees each -	48 - -	
1840, November	" Duftery, from March 1839 to January 1841, being 1 year 11 months -	11 - -	
	" A book for Coal Committee use, named "Turner's Chemistry" -	Rs. 12 - -	
	" A book, "Lardner's Cyclop. Manuf. in Metal" -	Rs. 15 - -	
1839, December	" Mounting three mps with cloth, and teak-wood rollers -	27 - -	
1840, January	" Freight and Bangle charges for 1840 -	24 - -	
	" Custom House duty -	44 7 9	
	" A maund of spirits of wine -	Rs. 20 - -	
	" A maund of spirits of wine, six dozen of corks, a box, and an ounce of gum copal, sent to Captain Jenkins, Commissioner of Assam -	29 4 -	
	" Five tin boxes, made for collecting objects of natural history, to be sent to Assam and Arracan -	23 3 -	
	" Four and a half dozen of bottles, for collecting objects of natural history -	22 8 -	
	" Corks, arsenic, &c. -	7 8 9	
	" 13 lbs. brass wire, of sorts, at Rs. 1. 8. per lb. -	2 10 -	
	" Two paint brushes and varnish -	2 13 -	
	" 30 lbs. earth oil, at 15 rupees per maund -	5 10 -	
	" 10 lbs. charcoal, at Rs. 1. 14. per maund -	3 9 -	
		Rs. 11,905 5 9	
			Rs. 5,336 15 4
			Rs. 420 8 -

APPENDIX.

APPENDIX, No. 1.

A TABLE showing the EXPENSE of Transporting SYLHET COALS by Water to the different STATIONS on the Ganges, by *George Loch, Esq., C.S.*

Price of 100,000 maunds, at 22 rupees per 100 maunds - -	Rs. 22,000	Price of one 600-maunds boat for one month, at 3 rupees per 100 maunds - - - -	Rs. 18
Salary to local agent, at 50 rupees per mensem - - -	600	One manjy, at 4 rupees - - -	4
Expense of conveying the Coal from Terriah Ghat to Pandua - -	2,000	Six dandies, at 3 rupees each - -	18
Expense of building a depôt - -	200		
	Rs. 24,800		Rs. 40

STATEMENT of the probable COST of SYLHET COAL at the different DEPÔTS.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
Station to which Coal is to be Dispatched.	Distance from and to Sylhet.	Quantity of Coal required.	Boat of 600 Maunds.	Price of Coal per Maund on delivery at Chattuk Depôt.	Total Price of Coal at Chattuk Depôt	Expense of Carriage to various Stations.	Total of Columns 6 and 7.	Rate for 100 Maunds on Delivery.	Rate per Maund on Delivery.	
	Mos. dys.	Mds.	No.	Men.	As.	Rs. a. p.	Rt. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Cutwa -	1 15	8,000	16	112	4	1,984 - -	960 - -	2,944 - -	36 12 9	- 5 10
Berbampore -	1 15	8,000	16	112	4	1,984 - -	960 - -	2,944 - -	36 12 9	- 5 10
Kulna -	1 15	8,000	16	112	4	1,984 - -	960 - -	2,944 - -	36 12 9	- 5 10
Commercolly -	2 0	8,000	16	112	4	1,984 - -	1,280 - -	3,264 - -	40 12 9	- 6 6
Sardah -	2 0	8,000	16	112	4	1,984 - -	1,280 - -	3,264 - -	40 12 9	- 6 6
Colgong -	2 0	8,000	16	112	4	1,984 - -	1,280 - -	3,264 - -	40 12 9	- 6 6
Rajmehal -	3 0	8,000	16	112	4	1,984 - -	1,920 - -	3,904 - -	48 12 9	- 7 9
Mongyr -	3 0	8,000	16	112	4	1,984 - -	1,920 - -	3,904 - -	48 12 9	- 7 9
Dinapore -	3 0	8,000	15	112	4	1,984 - -	1,920 - -	3,904 - -	48 12 9	- 7 9
Gazeepore -	4 0	8,000	16	112	4	1,984 - -	2,560 - -	4,544 - -	56 12 9	- 9 1
Mirzapore -	4 0	8,000	16	112	4	1,984 - -	2,560 - -	4,544 - -	56 12 9	- 9 1
Allahabad -	5 0	12,000	24	168	4	2,976 - -	4,800 - -	7,776 - -	97 3 2	- 15 6

I have distributed the Coal to the various stations in these propositions, in order to give some idea of the expense of purchasing and forwarding it. The Committee will of course give the instructions regarding the quantity of Coal required at each station.

(signed) *G. Loch, Deputy Collector.*

APPENDIX, No. 2.

ANSWERS to Queries regarding the manufacture of Cast Steel by *Mr. W. Turner*, late in the service of the Raja of Travancore, and formerly employed in one of the largest Foundries in England (*vide* Proceedings, October 1839, paragraph 4).

Desiderata and queries respecting the manufacture of Wootz, or Indian Steel.

1. Specimens of the iron ore in its natural state.

2. From what mine, and in what district procured?

1. I herewith forward you specimens of iron ore : first, in its natural state ; secondly, roasted ready to be broken and mixed with the limestone or other flux ; and, thirdly, the iron ore mixed with limestone as flux.

2. My iron marked in the question No. 2 is found in the Erneel district, not above two miles in a direct line from the Oodagherry Fort.

3. The first process of smelting the ore, in what kind of furnace, and what fuel employed?

4. Specimens of the first running and scoria.

5. Specimens of all the subsequent processes, and descriptions of them until completed in the form of the flat cakes in which it is usually made and exported from India.

6. In what kind of crucible is it melted?

7. In what substance or materials is the fluid metal poured, whether sand or wood? Is it poured on a flat surface or into a cavity; if into a mould, what is the nature of that mould?

8. Are the cakes left to cool in the crucible or are they poured out?

9. Is each cake the produce of one crucible, or is it poured from a larger quantity?

10. A crucible fitted with materials ready to put into the furnace, for fusion the last time.

11. A crucible with the mass left in it, as taken out of the furnace of the fusion.

3. The first process of smelting. The ore is previously roasted in a kiln; after its being kilned, is broken to the size which you will find mixed in one of the small boxes. I send you a rough plan of my furnaces, &c., as I am not a draughtsman, but a practical mechanic. Such is the plan of my present furnace and foundry; the whole expenses of which, together with the machinery, may not exceed 8,000 rupees. The fuel is charcoal, made under my superintendence, and will carry a burden equal to coke.

4. Specimens of the first and second running are enclosed in the box.

5. The first process used by me is to charge the cast steel crucible with the quantity of iron required, together with a certain quantity of bone ashes. There may be added a small portion of burnt leather, and a small quantity of Kisheygrey cast iron to give it a portion of carbon after its being decarbonized. It is necessary to anneal it 15 or 16 times; if it is made in this way, it is immaterial into what kind of an ingot or mould the steel is poured; as when the steel is fluid it will run into anything, as would fluid iron; but the care in annealing it after is everything.

6. I have made cast steel in bars of 14 pounds weight; but I have found no crucible in India to stand more than six.

7. The substance of cast iron, together with the malleable iron and steel as produced from the ore, are contained in separate boxes. It is needless to ask me of moulding, or the nature of it.

8. The steel is sometimes left to cool in the crucible, and sometimes the crucible is crushed to the form the steel is required.

9. Each ingot or mould may be poured from one to a dozen crucibles; but each man should take care to be ready at one time if a large is required.

10. A crucible filled with materials ready to be put into the furnace for fusion the last time is impossible for me to mention, there not being given any pressure or measurement of draught or blast.

11. I send you a crucible with the mass in it, but not properly fused, in order to show you and the gentlemen of the Committee what size pieces are to be put in previous to introducing the blast into the furnace: I send you also pieces of steel produced from the two different ores.

LIST of SPECIMENS delivered by Mr. Turner to the Master Attendant at Quilon, to be sent to Calcutta by the first opportunity, in order to illustrate the above remarks.

1. Iron ore in its natural state.
2. Ditto, roasted.
3. Ditto, broken and mixed with limestone ready for the furnace.
4. Cast, still not properly fused in crucible, but showing the method of putting it into the crucible; and other specimens of malleable cast and wrought iron and steel as produced from the different ores.*

* The above interesting specimens are still retained at the Custom House of Quilon. The officer in charge of that Department has been requested to forward the package to Calcutta, addressed to the Secretary of the Coal and Iron Committee, or in the event of no vessel bound to Calcutta touching at that port, to send it to Bombay or Madras to the care of the Mint Master at either of those Presidencies for the Coal Committee. The questions on the margin were proposed by the Royal Asiatic Society, and a copy of them forwarded to the Governor General in 1837, and referred by his Lordship to the Committee.

APPENDIX, No. 3.

MEMORANDUM for the Information of the Coal Committee (*vide* Proceedings, September 1839, para. 3).

ON the 28th of August, I made trial of 10 maunds of the Mergue Coal discovered by Lieutenant Hutchinson in a river with the experiment steam vessel from Calcutta to Barrackpore. I commenced with the best Burdwan Coal, and the engines worked up to 30 revolutions between 12.27 p.m., and 2.32, being two hours and five minutes, 10½ maunds of Mergue Coal was consumed, the engines varying between 28 and 30 revolutions, but no steam blowing off; there was little, very little residuum, and the fires burnt with a bright crackling flame, the Coal having been subjected to many transfers, was small and mixed with a great deal of dust. Between 3° 36" and 5° 36" of the same day, being two hours, nine maunds of Burdwan Coal was consumed, the steam being kept well up, and the engines fluctuating between 28 and 30 revolutions; the Burdwan Coal was of the best description, and entirely free from dust. My impression is, that the Mergue Coal is quite equal to the best Burdwan Coal, and in one point preferable in giving less labour to the stokers. The Mergue Coal experimented upon has all the appearance of being gathered from the surface, and of having been subject to the overflowing of the river near which it is found. Should this have been the case, there is every reason to expect an improvement of quality as the mine is more deeply entered into. Since our Committee last met, I have no further communications from Tenasserim respecting Coal, but I have the pleasure to hand to the Committee specimens of iron and lead ores gathered in those provinces, and forwarded to me by Mr. Edward Rilly of Moulmain, with a memorandum description of the ores, and the sites whence they were taken.

Trial of Mergue
Coal by Captain
Johnston.

(signed) J. H. Johnston.

Calcutta, 9 September 1839.

APPENDIX, No. 4.

Major Sage's REPORT on PALAMOW COAL (*vide* Proceedings, March 1840, para. 7).

Dinapore, 29 February 1840.

To the Secretary to the Coal Committee.

Sir,

YOUR letter to my address, dated 19th October 1838, has only now been put into my hands, and the period which has elapsed may render such information as I have to offer to the Committee of little value. There may, however, be some portion of it not altogether worthless, and as I have long been of opinion that the Coal fields of Palamow have met with unmerited neglect, I trust this communication may have the effect of placing that district and its resources in a more prominent situation before the Government than it has hitherto held.

Palamow Coal.

2. The situations in this neighbourhood, as far as my knowledge extends, at which Coal is found, are Singra, the Gorassan Nullah, and the neighbourhood of the village of Hotar, on the Burra river. These sites are all in Palamow, and are distant from the Soane, which is navigable during the rains, from 60 to 35 miles.

3. A depôt for the produce of these Coal fields would, in the existing state of things, be most conveniently formed at Bunder Ghaut, on the Soane, which river is navigable all the rains from this point for boats of 600 maunds burthen. The expense would be for land carriage to the Soane, including the raising of the Coal, four annas per maund freight from Bunder Ghaut to Dinapore, including shipping, &c., two annas per maund; total, per 100 maunds, Rs. 37. 8.

4. I am not aware that the mines alluded to above have been worked since the Cole War, previously to which I had supplies of Coal brought from Singra every year; nor am I of opinion that there is at present either capital or energy sufficient in India for individual enterprises of such magnitude, and where the returns, though certain, must necessarily be slow; I therefore despair of seeing these mines worked, unless the Government were to take the matter in hand, and by a cut connect the Coyle, Gorassan, and Gungary rivers with the heads of the Great Pompon, when, by a bund across the Coyle, granite being in abundance on the spot, and levelling and locking the Pompon, a depôt might be formed at Futwah, below Patna. The Great Pompon would thus become a canal, for which it is admirably suited, and the Coyle converted into a basin of water, from which the canal could be constantly fed.

5. The value of these Palamow Coals is not, I think, known, or they would not have been so long neglected. When I first established the fact, in 1830, of these mines yielding a good and useful fuel, it appeared desirable to test the value of the Coal as compared with that of Burdwan, and a specimen was selected for this purpose from Singra, colour

partly velvet, partly iron black massive lustre, shining, resinous, the different layers varying considerably—principal fracture, slaty cross fracture; small-grained, uneven fragments, approaching cubical, easily frangible; specific gravity 1·30; burns with little flame, and gives but little or no smoke.

6. (A.) One hundred grains in a close vessel were exposed to a heat gradually raised to redness, and kept so, until everything volatile had been driven off. The coke remaining in the vessel had nearly the appearance of the original Coal; its weight amounted to 53 grains.

(B.) It was now put into a platinum crucible, and kept burning until everything combustible was entirely dissipated, the ashes or earthy matter remaining, which were of a greyish white colour, were found to be a mixture of sulphate of lime, silica, and alumina, weighing together 6·8 grains.

(C.) The volatile matter driven off in experiment (A.) had partly made its escape in the form of gas, and partly condensed into a liquid, which, on examination, proved to be principally water, with a small quantity of bituminous matter and a strong ammoniacal odour.

7. The same experiments for the sake of comparison were made with the Burdwan Coal, with somewhat different results; a much greater quantity of tarry matter was given off, and the coke was found fused into a solid piece; it weighed 59·8 grains, and, when burnt to ashes, left 13·6 grains of earthy matter; from these, and a number of similarly conducted experiments, the following proved to be the composition of the Coals.

	Dinapore.	Burdwan.
Coke - - - - -	46·2	46·2
Volatile matter - - - - -	47·0	40·2
Earthy matter - - - - -	6·8	13·6
TOTAL - - - - -	100·0	100·0

8. Taking these results into consideration, I would propose in reply to your 4th paragraph, Futwa (pursuing the means pointed out for opening the communication) as a general depôt, for Colgong, Rajmahal, Monghyr, Dinapore, Gazeepore, Mirzapore, and Allahabad, and, for reasons which will be adduced hereafter, I will select Cutwa or Culna, as a general depôt for Berhampore, Calcutta, Comercolly, Surdah, &c. I had this subject in view many years ago, and have only to extract from a letter placed before the Government of that day to put the Committee in possession of what even then appeared to me a matter of some importance.

9. It may not be unworthy the consideration of Government, whether it may not be highly expedient to endeavour to render Coal cheaper to the public than it is now furnished. The shafts of the Burdwan mines, sunk by the late Mr. Jones, are, I understand, in the same state as when left by that gentleman; they have not been in any degree deepened, but merely extended, as Coal was wanted, horizontally; and there is every reason to believe, that up to the present day nothing more than what in England are called “firsts” and “seconds” have been brought into the market, the main, or Coal, remaining untouched.

10. It being obviously the interest of Government as well as of the public to secure a good and cheap fuel ere the progress of agriculture shall deprive Calcutta and its environs of the supplies at present furnished by the Sunderbunds and Saltwater Lakes, and which the introduction of steam-engines into general use, whether for the purposes of navigations or manufactures, must soon make an imperative necessity, it would, I am of opinion, be most advisable that the Burdwan mines should be accurately surveyed by competent persons, and their extent ascertained by boring.

11. Mr. Jones supposes the Coal to pass under the whole valley of the Ganges, and to rise again in the Sylhet Hills. This certainly would appear, from the known characteristics of Coal formations, to be most probably the case, as no rock intervenes to terminate its course.

12. If, as Mr. Jones supposes, it does take that direction, and which he was led to conjecture from its inclination, it would underlie the Hooghly at its most accessible depths, from Kisanagur to Cutwa, and I would, therefore, advise, that no ordinary means should be taken to ascertain the point, commencing first with the line from Nuddea to Cutwa, and thence along the Adji river.

13. Should a vein or continuation of a vein be discovered on this line in a part or parts having water communication with the Presidency at all times of the year, the object would

would at once be attained. But supposing the line from Nuddea to Cutwa affords no Coal, and the further line of the Adji did, at points not accessible in the dry season, yet as there are large quantities of iron ores in the neighbourhood, it might answer extremely well to have a rail or train road constructed from the Coal pits to the nearest navigable part of the Adji or Hooghly, while from a jetty the waggons might be unloaded directly into the boats, and a constant and cheap supply of fuel be thus made available to the public and the Government.

14. Should, however, a correct survey of these lines not encourage the idea of Coal in sufficient quantities, and good—being within accessible depths, on the Adji, or from Cutwa to Nuddea—still it would be advisable to ascertain the practicability of connecting the present mines by means of a canal with the Bankakal, which runs by the town of Burdwan, and meets the Hooghly near Culna within the reach of the tides.

15. I have reason to suppose it would not be expensive or difficult to render this nullah navigable at all seasons. The section of its bed is deep and of little width, and its banks are protected by hard clay. I have also understood the late Raja of Burdwan was so anxious to have the Bankakal made navigable, that he would contribute partly to the expense.

16. From the head of the nullah to Mudjea, the lowest Coal mine is about 30 miles, and the whole distance is a low dead flat country, through which a narrow canal for Coal boats could be constructed at an expense not exceeding 60,000 rupees.

17. The expense of opening these communications with the abundant fields of Coal which lie in the Pachete and Palamow countries would be amply repaid by the increased consumption caused by the extension of steam communication, to say nothing of opening a direct intercourse with a country abounding in iron, timber, granite, lime, and Coal, for such is the country of Palamow, a description of the Coal fields, which will be found in the "Gleanings of Science," No. 19, July 1830, page 217.

I have, &c.
(signed) *Wm. Sage.*

APPENDIX, No. 5.

SECOND REPORT of Mr. *Ravenshaw* on PALAMOW COAL (*vide* Proceedings, March 1840, para. 7).

DURING my late tour in Behar, I made particular inquiries from the natives regarding the existence of Coal in the hills to the S. W. of Pergunnah Juplah and north of the River Coyl, which unites with the Soane, a little below Rhotas. Though it was generally understood to exist, I could find no one who had visited the site, or could describe its precise locality. I, therefore, left instructions with several natives to send me any information they might be able to obtain on the subject, and if the site should be discovered, to ascertain the size of the mine, and the expense of digging and transporting the Coal to the nearest navigable river. In pursuance of these arrangements, a native of respectability who resides at Hoosseinabad, proceeded to the part of the country, which public rumour assigned as site of the Coal beds, and he has just returned, bringing with him three maunds of the mineral.

2. He states that the mine is on the side of a hill near the village of Sangur, which is situated on the banks of the Amanut Nuddee, a mountain stream, which flows into the Coyl river, about a quarter kos distant. Sangra is about four kos north-east from Palamow, and 16 kos south-west from Hoosseinabad. The quantity of the Coal he represents to be very great, to use his expression, "Lacks of maunds." Of the quality I am no judge; it is of a duller colour than the Burdwan Coal, with which I have compared it, and does not appear to burn quite so well; however, if it will answer for steam purposes, it is all that is required.

3. The country is said to be more or less hilly all the way to Hoosseinabad, and the road impassable for carts, but the Coal can be transported on bullocks, which carry between three or four maunds each. The hire per bullock to Boodun Ghat on the Soane (two kos beyond Hoosseinabad) is one rupee each. Boats of 1,000 maunds burdén come up to this ghat from Patna, the hire to which place is stated at 20 rupees, and the whole expense of digging and conveying 1,000 maunds to Dinapore as per annexed account, is estimated at Rs. 424. 9., or 6 a. 9 p. per maund. It would be necessary, however, to appoint a small establishment on the spot to look after the Coolies or Dhangurs, which might increase the expense to seven annas per maund; but, on the other hand, if a road were made by Government, and carts employed, a considerable reduction might be effected. Even at seven annas per maund, I imagine, the saving to Government would be great, as I understand the Burdwan Coal cannot be landed at Dinapore under one rupee per maund.

4. If the Coyl river were navigable, there would be only half a mile of land carriage, but my informant states, that the bed is too rocky to admit of boats coming up at any time of the year.

5. The native states, that after leaving the mine, he was informed that a Mr. Taitoo (so he pronounced the name) had proceeded thither from Dinapore by the circuitous route of Mougeah and Legsigjee on the south bank of the Coyl Nuddee. If this be true, and he should have been deputed for the purpose by Government, my present communication will be of no use, as that officer will probably have made all the necessary inquiries with respect to the practicability and advantage of working mine—but if not, I would suggest the deputation of an officer to examine the mine, and report on the feasibility of constructing a cart road from Sangra to Hoosseinabad, or of rendering the Coyl navigable.

6. A rough sketch, showing the locality of the mine, is herewith submitted for the information of Government.

I have, &c.
(signed) *E. Ravenshaw*,
Officiating Commissioner.

Commissioner's Office, Patna Division,
9 April 1839.

APPENDIX, No. 6.

REPORT on PALAMOW COAL, being a Letter from *E. C. Ravenshaw*, Esq., Officiating Commissioner of Patna, to the Secretary to the Government of Bengal, dated 6th January 1840 (*vide* Proceedings, March 1840, para. 7).

Palamow Coal.

WITH reference to your letter, No. 161, dated 11th July last, instructing me to adopt measures for laying in a supply of the Coal of Koila Nuddee at Dinapore, I have the honour to report, for the information of Government, that Cazee Mahanudee of Purgunnah Jupla, having communicated to me the discovery of another mine at a place called Chuppre, two kos south of the Soane river, before its junction with the Koila Nuddee, and having submitted an estimate of the expense of conveying it to Dinapore, which amounted to only 4 *a.* 5½ *p.* per maund, I advanced to him the sum of 300 rupees to enable him to commence operations immediately.

2. The specimen of Coal forwarded to me from this mine appeared precisely similar in quality to that from the Singra mines, but after digging 100 maunds the Coal is stated to have assumed a more stony character, and the Cazee therefore abandoned the mine, and proceeded to the old mines of Singra and Meeral, near the banks of Koila Nuddee. He has completed the excavation of 4,000 maunds, of which he has conveyed on bullocks 400 maunds to Dearee Ghat on the Soane, a distance of 16 kos, and 1,600 maunds to Pokree, half way between Singra and Dearee Ghat. The expense incurred, including the transport of 100 maunds from Chuppre to Dearee, amounted to *Rs.* 518. 8. 8. For transporting the remainder of the Coal to Dearee, and thence to Dinapore, the Cazee applied to me for a further advance. The expense (as per enclosed estimate submitted by the Cazee) of conveying the whole at Dinapore is *Rs.* 1,510. 3., of which *Rs.* 10. 3. was expended on the Chuppre Coal, leaving 1,500 rupees or six annas per maund as the total expense of transporting 4,000 maunds to Dinapore. I have accordingly to solicit the sanction of Government to the disbursement of *Rs.* 1,510. 3. on the above account.

3. Owing to the shallowness of the Soane at this season, I fear the Coal cannot be transported to Dinapore until the next rainy season, *i. e.*, July. I have directed the Cazee to convey the whole of the 4,000 maunds on bullocks to Dearee Ghat without delay, where it will be placed in depôt until a favourable opportunity may present itself of conveying it to Dinapore. If a heavy fall of rain should occur in this month, similar to that which occurred last year at this time, it is probable that the Coal may be moved sooner than anticipated.

4. In future (supposing the Coal to answer) it will be advisable that the total quantity required for the steamers in one year should be excavated, and conveyed to Dearee Ghat during the cold weather when the hire of bullocks is said to be cheapest, and from Dearee it can be annually conveyed to Dinapore in July or August.

5. If it be thought expedient, I think I shall be able to procure a contract for the annual supply of any quantity of Coal at six annas per maund, but until the Coal has been pronounced sufficiently good in quality for steam purposes, it would not be advisable to subscribe to such terms. The Cazee brought 24½ maunds of Coal to Dinapore in one of his own carts, for which no charge has been made. As I was directed by Government to forward a portion of the Coal to Calcutta for trial, I instructed Mr. Kidd, the agent for steamers at Dinapore, to transmit the 240 maunds to the Mint at Calcutta, and he reported on the 30th December, No. 1, that he had shipped it, on the 23d idem, in 13 bags on board a steamer, commanded by Captain Somerville. It may be proper to mention that four or five maunds of the Chuppre Coal, brought by the Cazee as a specimen, has been inadvertently mixed up with the Singra Coal. It will probably be distinguished by its strong character, approaching to anthracite, if it be not entirely composed of that mineral.

6. It is possible that the Coal might be procured at a cheaper rate than even six annas per maund, for in every estimate yet furnished, the hire or carriage, &c., has differed considerably.

siderably. It will be observed that the hire for bullocks in the present estimate greatly exceeds that in the last. The cause of this will be inquired into, but it shows that we have as yet no fixed data by which to calculate the exact cost. A knowledge of the mode in which Coal is conveyed from the Burdwan Mines to Calcutta, and the details of the expense, might be a useful guide in the present instance. To the amount of the estimate it will, in future, be necessary to add a small sum, by way of "malikana," to the proprietors of the mehal in which the mines are situated, as they have already informed the Cazeer that they will not permit any more Coal to be taken away unless they receive something for granting the privilege of excavating the Coal.

Commissioner's Office, Patna Division,
Sarun, 6 January 1840.

I have, &c.
(signed) *E. C. Ravenshaw.*

APPENDIX No. 7.

TOTAL Expense of Transporting Coal from Singra and Mural Hills.

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
2,000 Coolies' hire for carrying 4,000 maunds of Coal, at 15 Coolies per rupee (or 6 pie each), the exchange being at 22½ gundahs per rupee - - - -	133	5	4			
1,000 maunds Singra Coal.						
3,000 maunds Mural Coal.						
100 Bullocks, conveying 400 maunds of Coal from Singra to Dearee Ghat, distance of 16 coss, at <i>Rs.</i> 1 4 <i>a.</i> each bullock - - - -	125	-	-			
400 Bullocks, conveying 1,600 maunds of Coal from Singra to Pokhree, eight coss distance, at 11 annas each -	250	-	-			
				508	5	4
50 Coolies' hire for digging 100 maunds of Coal at Chuppre Hill - - - -	3	5	4			
25 Bullocks, conveying ditto from Chuppre to Khota, two coss distance, at four annas each - - - -	6	4	-			
1 Boat hire ditto from Khokah to Dearee - - - -	-	8	-			
2 Coolies' hire conveying Coals from boat - - - -	-	2	-			
				10	3	4
Received from Collector of Behar - - - -	300	-	-	518	8	8
Ditto from Mr. Kidd - - - -	10	-	-			
				310	-	-
Balance due - - - <i>Rs.</i>				207	8	8

Advance wanted for Transporting 2,000 Maunds of Coal now at Singra Hill.

500 Bullocks' hire, conveying 2,000 maunds of Coal from Singra to Dearee, 16 coss distance, at <i>Rs.</i> 1 4 <i>a.</i> each	625	-	-			
400 Bullocks' hire, conveying 1,600 maunds of Coal from Pokhree to Dearee, 8 coss distance, at 10 annas each	250	-	-			
				875	-	-
Boat hire, conveying 4,000 maunds of Coal from Dearee to Dinapore - - - -	80	-	-			
Wages from chowkedars to take care of the Coal, and coolies' hire to put on boat - - - -	36	10	4			
				116	10	4
				991	10	4
				518	8	8
TOTAL - - - <i>Rs.</i>				1,510	3	-
Deduct for 100 maunds of Chuppre Coal - - - -				10	3	-
Total expense of 4,000 maunds, equal to six annas per maund - <i>Rs.</i>				1,500	-	-

Commissioner's Office, Patna Division,
6 January 1840.

(signed) *E. C. Ravenshaw,*
Officiating Commissioner.

APPENDIX, No. 8.

LETTER from Major *Carter* to Major *Henderson*, Member of the Coal Committee.
Vide Proceedings of the Coal Committee for January 1841, para 1.

Cherra Poonji Coal.

IN as far as three months' anxious examination and inquiry as to the best method of obtaining a quantity of Coal from the Cherra Mine enables me to speak, the Coal Committee are most welcome to any information I can afford, although I fear they will find it of little value. You are aware that the mine which yields the Coal tested with the Burdwan is situated near the summit of a ridge which nearly surrounds the station, above which it rises about 300 feet. There is no difficulty, beyond the mere labour of quarrying the Coal, in obtaining any quantity. There is at present an extent of about 300 yards, forming two sides of a triangle exposed, the thickness of the seam being from 12 to 7 feet. There is also a small mine, distant about 100 yards from the above, which is even thicker than it, and I rather think a better Coal, though all appears good. The grand difficulty, therefore, in obtaining any desirable quantity rests in the want of carriage, and to overcome this the attention of every one on the spot has been directed. By the present method of using Cossia Coolies, nothing more can be done than has been effected by Lister and H. Inglis, and no private individual could have done what they have; for the work is exhausting, and, I believe, unpopular with the inhabitants, although they have been well paid. You will have been informed that the horizontal distance from the mine to Teria Ghaut is about eight miles, and the height of the mine about 4,200 feet above the river. Had this ascent been divisible equally through the distance, a practicable road could have easily been constructed; but unfortunately, for about three miles from the pit, and somewhat less than one from the river, there is little slope; consequently, the whole ascent is thrown on the four miles between these two comparatively level spaces, before any other description of carriage other than coolies can be used effectively. It will be necessary so far to lengthen the road as to reduce the ascent from one foot in about six to one in 10, or even 12; and this can be done at a very trifling expense, the soil offering very little impediment in the shape of masses of rock or strata, although, of course, some blasting must be expected. Judging by the quantity of work already done by Lister, it would, I think, be impossible to find one more capable of executing this. Trains, slides, roads, and machinery have all been suggested as suited to this steep portion of the road, and no doubt 1,000 or 1,200 feet could be overcome by some of the simpler forms of machinery; but I doubt whether by their use much, if any, reduction in cost would be effected by the double lifting. At each pulley breakage would occur, besides the necessary establishment for working whatever engines might be used, and carriage of the Coal from one to the other. After weighing every suggestion of others, and every plan that occurred to myself, I have little doubt but small bullocks are the best if not the only mode by which a quantity, to be of any importance to such a port as Calcutta, can be brought down at such a cost as to be desirable. There is abundance of forage for any number. I know they traverse Southern India in vast numbers, and have scarcely a march in which hills do not occur, the roads often covered with gravel more injurious to the feet than that in the Cherra hills; still it will be necessary to induce private enterprise to make the experiment, so as to have the lowest cost at which the thing can be done ascertained. In regard to boats, were there a demand, I do not contemplate any difficulty in the supply; good 500-maund boats are built at Sylhet, Chattuck, and various other places in the neighbourhood, for 150 to 80 rupees, and the whole population may be termed aquatic. Cherra offers advantages for the supply of Madras and Ceylon, which I have not seen adverted to. Vast numbers of seagoing vessels carry salt up to Naraingunge and other places on the Megna; these could be laden in five or six days from Cherra, and in the cold weather could cross the bay without danger; indeed, numbers of similar craft carry bin* to the coast from the port of Arracan. I mentioned that I thought Lister and H. Inglis had done as much as can be expected with the natives: they are both very anxious, and have much influence; yet I doubt if, in future years, they could do what they now have accomplished, from a cause which, however inimical to your researches, will be viewed favourably by Government—the increasing traffic of the country under their superintendence. The export of iron, cotton, and potatoes is great; the latter has increased from a few maunds at present to many thousands, every one of which take the labour of a man three days or four, according to where they are grown, to transport to the ghaut.

Bullocks proposed
as the best means
for its conveyance.

If the road were completed at the moderate slope of 1 foot in 12, small carts might be used perhaps, but even then I doubt if the laden bullock would not be cheaper; for at least one man would be necessary to each cart, whereas one could drive four or five of the others, who would have nothing to bring back, while an empty cart up a continued ascent would be as exhausting as a laden one down.

You, as a practical mechanic, can tell better than I what would be the advantage, in regard to expense, of employing machinery to lower the Coal; even 2,000 feet, on a horizontal distance of, say, one mile. I think it would increase it, for from the nature of the country, a direct line could not be attained; consequently, one machine and one set of tackle would not answer.

I enclose

* A black pea, on which cattle are fed.

I enclose you a view, done by Hone of the 57th, of the mine at Cherra; the hill is about 300 feet high, and the Coal stratum about 80 or 90 from the top. The smaller mine, and which has been worked by Government, is in the nook to the left; the Coal is there nearly 15 feet thick; it is 12 just behind the angle where it ceases in the sketch. You have now, my H., the result of my cogitations on the subject of Cherra Coal, which may be resolved into this: Make a road—which, with the aid of a couple of hundred convicts* from Sylhet, where they appear abundant, would, I think, be accomplished under 2,000 rupees—and the Coal will come down, whether by means of private or public exertions will not matter.

13 October 1840.

Ever, &c.
(signed) H. Carter.

APPENDIX, No. 9.

NOTES from CORRESPONDENCE by the Secretary regarding Petroleum, and other subjects connected with the business of the Committee. *Vide* Proceedings, para. 2, January 1841

CAPTAIN BOGLE, the Commissioner of Arracan, in a letter dated 18th July, reports the dispatch of four jars of petroleum, the produce of three wells of that mineral close together, at a place called Laidong, about five or six miles distant from Ramree town, on the island of the same name. The situation of the wells is further stated to be only two or three miles distant from the Cheduba roadstead, with a good road all the way. The wells are about 8 or 10 fathoms deep, and around them, the surface is scantily covered with stunted jungle. The wells are, however, very unproductive, not yielding above 10 or 12 maunds of petroleum in three months. To collect this the people descend by ladders, and apply earthen pots to the places from which the oil exudes, returning about the time when they expect to find them filled. At present there being no way of getting quit of the water, the only season during which the oil can be collected is during the months of February, March, and April. Captain Bogle thinks, if the wells were covered in and pumps employed, the work might probably be continued longer. Captain Bogle also thinks that if these wells were carried down to the depth of the petroleum wells in Ava, that a more abundant supply of oil might be obtained.

Petroleum and
Naphtha at Arracan.

The oil is however, Captain Bogle thinks, inferior to that of Yenangming in Ava, being thinner, and not congealing when exposed to the air. The Mugs use petroleum oil for their hair, and as a varnish for mats, and all the ornamental woodwork of their houses, for their polum-leaf books, &c., as it destroys insects and vermin; it is also a preservative against white ants. When burnt, Captain Bogle says it emits much smoke, and yields a strong offensive odour, which is at all times strong and disagreeable.

The number of wells about Ramree might, he thinks, be much increased as well as on Cheduba, where there are five wells much superior to those of Ramree, both as to the quality and quantity of the petroleum, but no attention is paid to them. Captain Bogle is of opinion that the Cheduba wells might be made to produce 1,000 maunds per annum, which, at the rate petroleum there sells for at present, would be worth 5,000 rupees. In fact, Captain Bogle states, there is no limit to the quantity which an enterprising man might obtain at a very trifling cost. On Flat Island, near Cheduba, Captain Bogle remarks, there is also a petroleum spring.

Such is Captain Bogle's account of these mineral oils; but as he has furnished the Coal Committee with four jars of them from different springs, we are enabled to add the following remarks: Two of the specimens furnished by Captain Bogle are naphtha, the purest of all bituminous oil, of pale straw yellow colour, perfectly thin and transparent, volatile and unctuous, with a resinous aromatic odour, and burn with a clear bright flame like olive oil, which they resemble in colour and transparency: specific gravity, 80·2. We should suppose both these specimens are the produce of the same spring.

Naphtha is a rare mineral production in a state of perfect purity, and we believe there are but two springs from which the supplies for Europe are derived. The one is situated at Monte Ciario, near Piacenza, in Italy, and the other near base of the mountains of Bucktiavi, between the city of Bruster and the valley of Ramharmous. We regard the Laidong naphtha from Ramree as pure as that of either of the two celebrated fountains alluded to. Hitherto, when bituminous oils were required for use, either in medicine or the arts, that of the celebrated wells of Yenangming in Ava has been used, which is rather a mineral tar than either petroleum or naphtha, yet Dr. Fleming remarks that in chronic rheumatism he found it of much greater benefit than the more costly cajeput oil; and if Dr. Fleming had been acquainted with the more pure bituminous oil of Ramree, we think he would have spoken of it even in higher terms: for while it is still a purer form of bitumen, it is capable, from its fine colour and transparency, of entering into the most elegant mixtures. The dirty tar-like and putrid appearance of the Ava petroleum would necessarily exclude it from the general list of remedies, except in veterinary practice, in which

* The suggestion regarding the employment of convicts is very important, particularly as the climate is found to answer admirably at Cherra for people from the plains.

which it is still used; but none of these objections apply to the Laidong naphtha, which, while it possesses the qualities of the other bituminous oils in the highest degree, presents the most agreeable appearance.

The other two specimens received from Captain Bogle are petroleum of different degrees of purity, but both very fine—one in particular, which is almost as pure as naphtha itself; but it is high-coloured, like brown sherry; its specific gravity is 81·2. The third specimen, also petroleum, is of still higher colour and somewhat opaque, is also a good petroleum: specific gravity, 82·4. These last two specimens are, doubtless, the produce of two different wells; but as the jars were not numbered, nor the peculiarities by which the three wells are distinguished from each other pointed out by Captain Bogle, he will still have to distinguish the naphtha well from those producing the petroleum, which he will be enabled to do by the colour of the liquid—the naphtha being pale yellow and perfectly transparent, while the petroleum is brown and slightly opaque.

The petroleum of Laidong would be useful in the arts as a varnish for preserving objects from insects, a purpose for which the Ava petroleum (which is, in fact, mineral tar) is quite unfit, from its dirty appearance and opacity.

Petroleum in Assam.

Petroleum has also been plentifully found by Captain Hannay in the Jeypore Coal district of Upper Assam, where it presents itself rising from beds of Coal. Mr. Griffith and Lieutenant Bigg also found springs of petroleum at Namroop, in Upper Assam.

Petroleum in Sylhet.

Petroleum is also a product of the Sylhet district. Major Lister, Political Agent in the Kasyah Hills, reports, in a letter to the Coal Committee, dated 15th May last, that there are three localities, 10 or 12 miles distant from each other, where springs occur, but not being an article of trade, the petroleum is only used for medicinal purposes. We have been favoured by Mr. H. Inglis with a sample of petroleum from one of these localities, and find it to be very pure, yielding no precipitate with alcohol, and of a clear red colour: specific gravity, 89·5. What we have said of the Laidong petroleum applies to this, which would be an useful varnish as a protection against insects.

Petroleum on the Euphrates.

On remaining for a certain length of time exposed to the air, petroleum assumes a solid form, in which it is found in many parts of the world, but particularly in Persia. Lieutenant Lynch, recently engaged in a survey of the Euphrates, turned the asphalt, which seems to be very abundant along the shores of that river, to account in the manufacture from it of an artificial fuel by mixing it with charcoal. The fuel was made up into the form of bricks, and, from the highly inflammable nature of both its materials, promises to become a useful fuel for long voyages, from its lightness and small bulk. In Calcutta, where petroleum sells for 15 rupees per maund, and charcoal for three or four, Lieutenant Lynch's fuel would be very expensive; but manufactured on the Euphrates, its price would probably be lower than of coal supplied on that river. As naphtha, petroleum, and asphalt are but the volatile bitumen of Coal, so their presence in any country may be regarded as an indication of the existence of that mineral. The first of these substances is bitumen in the purest form, collected before it has remained exposed for any length of time to the air; the second is when the substance has changed to a darker and more opaque form, which passes into asphaltum. As petroleum springs are usually situated in Coal districts, we infer from the presence of petroleum on the Euphrates that Coal also will be discovered on the banks of that river.

(signed) J. McClelland,
Secretary Coal Committee.

APPENDIX, No. 10.

JUBBULPORE.

Nerbudda Coal.

It had been understood in the Coal Committee, that a trace of Coal had only been found in sinking wells at Jubbulpore, and that the only good beds of Coal in the Nerbudda Valley were those brought to notice by Major Ouseley, near Hosingabad.

We have lately been informed, however, by Captain Ludlow, that an excellent Coal is found close to Jubbulpore, and furnishes that station with fuel. A specimen of this Coal, which bears the appearance of the best Burdwan kind, has been furnished by Captain Ludlow, who has kindly promised to induce some of his friends at Jubbulpore to procure a description of the mines in that vicinity.

APPENDIX, No. 11.

IRON.

Kasya Iron Ore.

A SAMPLE of the ironsand, a magnetic iron ore from which the Kasyas manufacture iron, together with nodules of iron pyrites from Cherra Poonjee, has been forwarded to the Coal Committee by Major Carter. Mr. Landers also has presented a specimen of iron pyrites, together with specimens of rocks, from the same quarter.

APPENDIX, No. 12.

MEMORANDUM by Captain J. H. Johnston, Controller of Steam Vessels, on the Trial of Coals, &c. *Vide Proceedings for January 1841, para. 3.*

MEMORANDUM.

I HAVE the honour to report to the Marine Board that, accompanied by C. W. Smith, Esq., C.S., President of Coal Committee, and J. McClelland, Esq., the secretary, I proceeded, on the "Lord William Bentinck" steam-vessel, to make trial of some manufactured fuel and two specimens of Coal from the Mergue and Dearee mines.

2. The first trial was made of fuel in the form of bricks, prepared by Mr. Fisson with the dust of the English Coal. The fires had been lighted and the steam got up with Coal from the Raneegunge Colliery; after starting from Chaundpaul Ghaut, the fires were allowed to burn down, and the engines to exhaust the steam. The Coal bricks were then thrown on, and when the steam began to blow off, the engines were started, and the fires again allowed to burn down; by which process the furnaces were supposed to be cleared of the Raneegunge Coal, and the remaining fuel to be of the nature on which the experiment was now to be made. I will here remark that the same process was adopted previous to making the experiment on each different sort of fuel.

Trial of Coals.

3. The engines stopped, having exhausted the steam, at 11.3, when nine maunds of brick-fuel having been placed in the boiler-room, the furnaces were supplied from it; and at 11.6 the steam was again up in the boiler, the engines were started at full power, making 21 revolutions. The steam-gauge indicating 3lb. pressure, it gradually fell, and the revolutions decreased to 20, until 11.40, when the engines stopped, the last 8 or 10 revolutions having been made with a gradual diminution of speed. At 11.43 the steam was again up, and the engine started at 21, 20½, 20, 19, until 12.10, when, the nine maunds of fuel being expended, the fires burned down, and the engines stopped at 12.15, having in the lapse of one hour nine minutes, including three minutes the engines were at rest, made 1,300 revolutions, with the consumption of nine maunds of fuel; and by proportion, had ten maunds been expended, the time occupied would have been 1 hour 16 minutes and 40 seconds, and the revolutions 8,454.

Artificial fuel.

4. The result of this experiment is far more satisfactory than that reported, in my memorandum of the 16th March, on Coal bricks made with the dust of Burdwan Coal. I shall endeavour further to improve on this last specimen, and have little doubt of success.

5. At 12.45 I started the engines with 10 maunds of Dearee Coal (Mr. Ravenshaw); at 1.45 the engines stopped; the steam-gauge never indicated more than two pounds pressure; the engines maintained barely 20 revolutions; the fire required much stirring and poking, and once, at 10 minutes after 1, the revolutions declined to 16. Of this Coal 10 maunds were consumed in an hour, during which time the engines made 1,180 revolutions. This Coal will not answer for internal navigation, as it will not keep up the steam for the full power of the engines; I will try it mixed with a proportion of English Coal, and report the result.

Dearee Coal.

6. Ten maunds of Coal from Lieutenant Hutchinson's mine in Mergue were now tried. The engines were started at 2.30 and stopped at 3.35; the gauges during the experiment indicating a pressure of little more than two pounds, and the engines making 21 and 20 revolutions. The result was 10 maunds of coal consumed in one hour and five minutes, and the engines supplied with steam for 1320 revolutions of the wheel. My expectation of this Coal has been disappointed; it is the first time I have had an opportunity of trying it in the furnaces; the analysis* of specimens sent up when the Coal was first discovered promised a better fuel; the Coal may have deteriorated from exposure, and from the overflowing of the nullah contiguous to the mine, which occurred during the last rains. The 20 tons received by the "William Dampier" is all in small pieces, very thinly coated with mud; judging from the trial made yesterday, I should pronounce the Coal inferior to the Coal of Raneegunge; there is a great deal of residuum, and amongst it a large proportion of slate.

Mergue Coal.

*Specific gravity	1.27
Water	- 18
Volatile matter	- 37
Carbon	- 40
Ferruginous matter	5
	100

†Note by the Secretary.—The Coal must have been too much heated in drying, and volatile matter driven off as well as "water."

Mergue Coal.

Steam Department, 28 November 1840.

(signed) J. H. Johnston,
Controller.

I am sorry to see an account of the Mergue Coal so little encouraging and so unexpected; perhaps, however, the specimen was an unfavourable one, and affected by the causes which Captain Johnston adverts to.

(signed) H. M. Parker.

This is still serviceable Coal; from its appearance there is reason to think that it has been taken from the surface, and that when the bed has been properly worked a better quality will be found.

C. W. Smith,
Chairman of the Coal Committee.

APPENDIX, No. 13.

No. 287.—MEMORANDUM.

IN continuation of my memorandum of the 28th November (No. 281), I beg to report that, desirous of making a further trial of the Mergue Coal in furnaces of more powerful draught than those of the "Lord William Bentinck," I got the steam up on board the "Ganges" on Thursday the 10th instant, and having weighed 18 maunds of picked Mergue Coal, I charged the furnaces with a quantity of the same Coal, raised steam, and worked it down again to clear the furnaces of English Coal, with which the steam had, in the first instance, been got up.

2. At 11.53 we began to throw on the fires the 18 maunds of Mergue Coal, the engines at this time making 24 revolutions, the steam-gauge standing at $1\frac{1}{2}$; at 12.10, the revolutions had increased to $25\frac{1}{2}$, steam-gauge $1\frac{1}{2}$; at 12.20 the revolutions were 27, gauge $2\frac{1}{2}$; at 12.35 revolutions 28 and 29, steam-gauge $3\frac{1}{2}$, and the steam blowing off; at 12.50 the whole of the 18 maunds had been thrown on the fires, and they were allowed to burn down gradually until 1.10 p.m., when the revolutions having diminished to 24, and the steam-gauge standing at $1\frac{1}{2}$, the same points from which the trial had commenced, the experiment was completed. English Coal was thrown on to get up the steam. Previous to commencing the trial at 11.53 a.m., the ashpits had been cleared from ashes; and at 1.10 p.m., when the trial had terminated, the ashes were drawn from the ashpits; and 36 hours after, when the water thrown upon them to prevent accident had been well drained off, they weighed 4 maunds 32 lbs.

3. This trial has been more satisfactory than that of the 28th ultimo on board the "Lord William Bentinck," whose boilers have less draught, inasmuch as the Coal has been found capable of raising the steam to the blowing-off point, and of maintaining the full speed of the engines. The quantity of Coal expended was considerable, and the residuum bore a very large proportion to the original quantity of Coal; but on examination of the ashes, I detected a large proportion of unburnt Coal in very small pieces, which had fallen through the bars, and this loss of fuel it will not be easy to remedy. The Coal being non-bituminous, or containing very little bitumen, will not coke, and consequently the smaller particles, though they might be separated from the ashes and again thrown on the furnaces, would immediately fall again through the bars; and if, to prevent this, the bars were placed much closer together, the draught would be impeded, and the Coal would not burn at all.

Trial of Coals.

4. The result of the above trial has been 18 maunds of Mergue picked Coal consumed in the furnaces of an 80-horse engine in 1 hour and 17 minutes, furnishing 2,015 revolutions, or 4,030 cylinders of steam.

5. Twelve maunds of English Coal, ex the "William Jardine," were now subjected to a similar trial; they lasted one hour and four minutes, furnishing 1,905 revolutions, 3,810 cylinders of steam, and leaving a residuum of 50 lbs. of ash.

6. On the 11th instant I put $3\frac{1}{2}$ maunds of Dearee or Mr. Ravenshaw's Coal into two furnaces of the "Ganges" boiler, the other two furnaces being charged with English Coal. The Dearee Coal burnt much brighter than in the "Bentinck's" boilers, and the steam was well kept up for 40 minutes, when the fires in the Dearee furnaces grew very dull and the steam went down; the residuum was 12 lbs. of ashes from the Dearee furnaces.

7. This Coal appears to me to be nearly all carbon, with a very small proportion of bitumen; the residuum is an almost impalpable white powder. The Coal will not answer alone for steamboats; but, combined with good English Coal, would, I have no doubt, keep up steam. I shall obtain a further quantity for trial in this way, and report more fully upon it.

(signed) J. H. Johnston,
Controller.

Steam Department, 12 December 1840.

APPENDIX, No. 14.

EXTRACT of a Letter from Mr. W. B. Turner, late Superintendent of the Rajah of Travancore's Iron Foundry,* on the Method of making Charcoal, &c. Vide Proceedings, January 1841, para. 10.

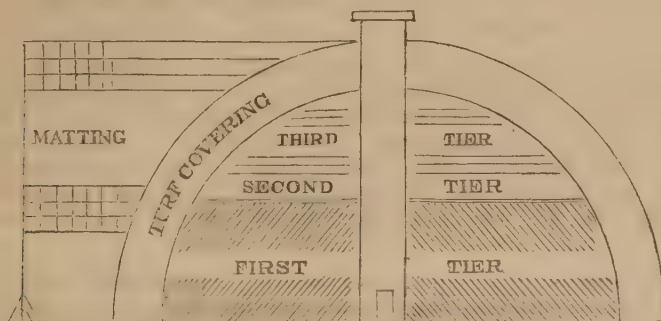
On making charcoal.

- 1st. The wood should be cut into pieces of from two to three feet in length.
- 2d. The wood should be sorted into three different sizes, taking care that the crookedest part

* Now Engineer on board the "Seaforth," Ceylon Colonial Government Steamboat.

part of the wood be cut at the bend, so as to throw it as straight as it will allow, in order that the wood may lay closer together.

3d. The ground on which the charcoal is to be burnt should be cleaned in a circle of from 20 to 25 feet diameter; there should then be a small round hole dug in the ground, of from 14 to 15 inches diameter, as may be perceived by the following drawing :—



4th. This being done, a small brick chimney or flue should be built in the centre of the kiln, and the second-sized wood should be placed around it, as near perpendicular as possible; it will stand on its end, and when the wood runs crooked, care should be taken to fill up the cavity with short pieces, in order to render the whole mass as solid as possible. This being completed, is called the first tier of the kiln when it is so filled as to reach the outside of the circle.

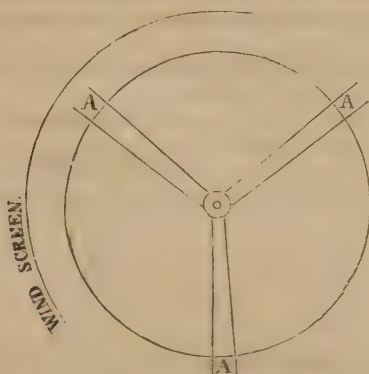
5th. The largest of the wood should be always sorted out for the second or horizontal tier, and should be laid as close as it is possible to the perpendicular or first tier, care being taken to fill up the vacant spaces as before mentioned; this tier should be raised in thickness equally, or a little more in height than that of the perpendicular of the first tier; the largest of the wood should always be placed in the heart of the kiln, in order to receive the largest portion of heat during the process of charring.

6th. Or last tier; the centre part should be filled up with the short pieces, perpendicular as the lower or bottom tier, and overlaid with small or short pieces in a sloping direction, in order to render the top of the kiln round, or like the top of a common coke-fire; this being completed may be called the finishing of the stacking process.

Making Charcoal for smelting iron.

7th. The whole mass should be covered over with reeds or dried grass when procurable, and then be covered with turfs, taking care to lay the grass side next to the wood, and laid as close together as possible to render the whole covering of the kiln as airtight as possible; when the whole should be covered or plastered with wet earth, in order that none of the heat may evaporate through the covering.

8th. This being completed there should be three holes, of about 12 inches diameter, made at the bottom, at right angles, in order to admit air, as you will perceive by the mark or letter in the following sketch:—



All being now completed, the kiln is ready for firing, which should be done by putting a few good pieces of lighted fire down the centre chimney or flue; when the whole mass is found to be well on fire, care should be taken to stop the lower air-hole on the wind side, in order to draw the fire on the wind side of the kiln. In windy weather it is necessary that a sheet, or a screen of mats, should be placed on the wind side of the kiln, as it sometimes happens that the air gets in, which makes the kiln burn, so that one

man is scarcely able to manage it; in this case it is generally found necessary to stop up all the air-holes; care should be taken never to admit of any fire being seen through the covering of the kiln, or any of the smoke to escape, excepting through the centre flue or chimney.

9th. Charcoal made after this process is proved to weigh twice the weight of the common native-made charcoal; it will also support a burden nearly equal to the first sort of coke. It has smelted ore, and also remelted old shot and shell, at the rate of one ton to one ton five cwt. of charcoal.

10th. The beauty and saving of making charcoal by this process is, that the pieces of wood as small as a finger will become charcoal, when lying or standing in the kiln, by the side of a piece of wood of from nine to ten inches in diameter, and the smallest piece will not be the least consumed. The centre flue or chimney should be kept open as long as any smoke is seen to escape from it; but when it has done smoking, the whole kiln, together with the chimney or centre flue, should immediately be stopped up airtight, when the fire will go out, and the kiln will be ready to draw for use in 24 hours.

11th. People ignorant of this process of charring have actually taken the wood to have been half burned until they have taken a piece and broke it, when, to their astonishment, they have found the thing they thought half-burnt wood to be excellent sound charcoal; and many people have balanced a piece across their hand and struck it with another, when it would give a sound similar to a bell. I have often been obliged to break this charcoal into short pieces, in order to keep my furnace or cupola from scaffolding or hanging with its burden.

APPENDIX, No. 16.

EXTRACT of a LETTER from Captain *R. Wroughton*, Revenue Surveyor, Mirzapore District, to *H. M. Elliot*, Esq., Secretary to the Sudder Board of Revenue, North-Western Provinces, 30 April 1840.

Singrowlie Coal.

2. I HAVE the honour to report, for the information of the Sudder Board of Revenue North-Western Provinces, that in prosecuting the survey of Purgunnah Singrowlie of this district, I have discovered a Coal-field, extensive, near the surface, and producing mineral of an excellent quality. The survey is not sufficiently advanced to admit of my placing before the Board an accurate map of the country intermediate between Singrowlie and the Ganges; but the accompanying rough sketch (No. 1) will sufficiently exhibit the position of the carboniferous formation with relation to the Soane River, and Mirzapore on the Ganges; while a second sketch and section-map, which are also submitted, will illustrate the site of the field with regard to Kotah, and show the various deposits of shale, sandstone, &c., alternating above and below the coal.

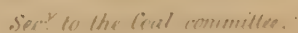
2. By this opportunity, I beg leave to forward specimens of the strata referred to in the section-map, and which have been excavated from a few feet below the surface, and particularly recommended to the notice of the Board; the specimens of coal (small-sized, and in duplicate) from B pit, No. 2 stratum, and C pit, No. 5 stratum. I have carefully examined both the specimens, and though they were obtained at points somewhat distant from each other—the one mixed with the solid amalgam of mercury, the other free of that mineral—the elements of each muster are much the same, and both samples are of excellent quality.

The specific gravity of specimens from B pit (No. 2), is 1·205; that from C pit (No. 5) 1·255, and the composition determined on 100 parts—

Specimen.	Volatile Matter.	Carbon.	Ash.
B Pit, No. 2 - - - - -	44·2	54·3	1·5
C Pit, No. 5 - - - - -	42·5	55·	2·5

3. The peculiar wild and rugged features of the Mirzapore district have rendered the survey duties very difficult and laborious; in the endeavour to execute that office satisfactorily, my time has been constantly occupied; so much so, I regret to say, as to prevent my pushing geological researches to any considerable extent, and the field for such inquiries is an admirable one. I am unable, therefore, at present to forward a full report upon the Coal formation of Singrowlie, but hereafter shall be happy to supply one, if the subject appears to the Board of sufficient importance. To effect the purpose properly, however, it will be necessary that I be provided with boring implements from the Chunar Magazine, as well as the services of an invalided sapper now at Chunar; and also

with relation to the Sone & Ganges River.



also that the expense incurred upon the requisite boring experiments be paid by the Government, an extent of assistance the Board will, I trust, not consider unreasonably solicited.

4. Referring to Arrowsmith's map of Hindoostan (1816), the Singrowlie Coal deposit is situated as near to Chunar on the Ganges as the Palamow mines are from the Soan river. I am given to understand that the Palamow colliery is now working for the purpose of supplying Coal to Benares, Dinapore, Mirzapore, and Allahabad, and if the rumour be correct, the more convenient availableness of the Singrowlie Coal renders the discovery of it, even thus far conducted, a matter of advantage; but many reasons induce me to believe that I can pursue the Kotah strata to some situation on, or adjacent to, the Goput river, which forms a conflux with the Soan at the town of Burdie, from whence the Coal could be conveniently and cheaply transported by a road uniting with the grand Mirzapoor and Jubulpoor thoroughfare to the Ganges. Burdie Pergunnah is, I believe, within the territory of the Rewah Raja, whose good-will and aid will, I conclude, be secured to me in the event of my being directed to institute inquiries for Coal in that quarter.

5. Should it so happen my conjecture upon finding Coal at Burdie proves visionary, the transport of the Kotah Coal to the Ganges could be contrived at a less expense than that now incurred for conveying Coal from Bengal to Mirzapoor and Allahabad, for it is generally agreed by those who have considered the question, that a bullock-load (or 2½ maunds) when Brinjarrah cattle are employed in numbers, can be brought from the Soan at Agharee to Chunar on the Ganges for 10 annas, or at about 4 annas per maund; the same charge for carriage would be incurred in carrying the Coal from Kotah to the Soan, and if it can be quarried at 1 or 2 annas per maund, the entire cost, for delivering it at Chunar will be 9 or 10 annas, which is 3 or 4 annas a maund less than what is now paid at Mirzapoor for the Burdwan Coal, but I am of opinion that the above estimate would be materially lessened if a cart road was established between Chunar and the Soan.

6. Saving the Jubulpoor great road which skirts a portion of the western side, and the road parallel and near to the Ganges, which runs from Chunar *viâ* Mirzapoor city to the Touse Nullah, there is no route whereby a wheel carriage can traverse the central, southern, and eastern parts of this extensive district. All communication in the shape of traffic is now carried on by laden bullocks, a means of conveyance expensive, and at the same time precarious and insufficient; I say precarious, because in crossing the several mountain streams that intersect the table land, the bullocks constantly lay, or fall down in the water and destroy their load; while no weighty or bulky article admits of being transported by such a mode.

7. If cart roads were constructed on the foot tracks now existing between Mirzapoor, Gopalpoor, Ghoraweel, and Silpee on the Soan; and again between Ahrorah, Sukout, Pussegee, Romp, Aykpowah Ghaut, and Run Buhardurpoor, on the Soan, the convenience would be hailed as a blessing by the people, and be the means of bringing the valuable productions of the Southern Pergunnahs, at this time almost shut out from any communication with either Mirzapoor and Benares, to a ready and profitable market.

8. An excellent road from Chunar, to about three miles beyond Ahrorah, and which is to extend to Seekrut, is already constructed; from thence to Romp, the country is flat, and the strong Argil soil resting on sandstone, could, at a trifling expense, be rendered traversable for carts; adjacent to Romp is the Aykpowah "Ghatee," or passage in descent over the Kymoor Hill to the Soan valley, a fall of 1,000 feet, particular points of this "Ghatee" are precipitous; and here there would be difficulty, but even this might be surmounted, and a passable thoroughfare for carts be constructed at a moderate sacrifice of labour and money, and which would be infinitely compensated by the benefit it would confer upon an extensive community.

9. The Board will, I trust, pardon my offering an opinion thus voluntarily upon a subject, unconnected with my immediate occupations; but having ascertained that the proposition is both feasible and universally desired, and that if carried into effect it would render the Singrowlie Coal deposit a discovery of much importance to the Government and the public, I cannot withhold it.

In conclusion, I beg to apologise for having occupied so much of the Board's valuable attention, but if this attempt to be useful should be favourably received, I shall have reason to be gratified.

I have, &c.
(signed) R. Wroughton, Captain,
Revenue Surveyor.

Camp Ahrorah, Chunar,
30 April 1840.

ABSTRACT of the PROCEEDINGS of a COMMITTEE for the Investigation of the COAL and MINERAL RESOURCES of INDIA, brought up to April 1842, by the Secretary.

The Committee, composed as follows, meet at half-past 10 A.M., on the first Monday of every month.

President:

J. W. Grant, Esq., Keeper of the Export Warehouse.

Members:

Major W. N. Forbes, Mint Master.

Major W. R. Fitzgerald, Superintending Engineer, S. E. Provinces.

Captain J. H. Johnston, Controller of Steam Vessels.

Captain A. Wilson, Superintendent Cossipore Foundry.

Junior Member and Secretary:

Assistant Surgeon, John M^cClelland, Deputy Apothecary, H.C.

June 1841.

PROCEEDINGS of a Meeting of the Coal Committee, held at the Mint, on the 3d June 1841.

Present:—C. W. Smith, Esq., President; Major Forbes and Captain Wilson, Members; and J. M^cClelland, Secretary.

Doobradgepore Coal.

Read a letter from Mr. James Pontet, dated 17th May 1841, announcing the dispatch of 15 maunds of Doobradgepore Coal from beds on the Burmany river. This is a hard, slaty Coal, evidently taken from a superficial bed.

Specific Gravity, 1.4.

Inflammable matter	-	-	-	-	-	-	-	-	-	42
Carbon	-	-	-	-	-	-	-	-	-	38
Ash	-	-	-	-	-	-	-	-	-	20
										100

Forty lbs., tried in the Laboratory, Honourable Company's Dispensary, proved to be a useful second or third rate Coal, and left about 8 lbs. of ashes.

Major Forbes also read a Report of an experiment made at the Mint on the previous day, June 2d, on this Doobradgepore Coal, a copy of which he promised early to send to the secretary.

Burdwan.

2. Read a letter from Mr. James Erskine, stating the difficulties and oppositions experienced by him in sending Coal at present down the Damooda.

Assam.

3. A Report from Mr. Landers on the Coal beds of Upper Assam was received; but as a map referred to in the Report had not yet reached the Committee, the reading of the Report was postponed.

Captain Johnston's trials of Coals.

4. Read a copy of a memorandum drawn up by Captain Johnston for the Marine Board, dated 10th May 1841, detailing the results of certain experiments, conducted by himself, for the trial of different Coals. Captain Johnston found eight maunds of Coal supplied by Mr. Homfray from a new mine, the locality of which he keeps secret, to keep up steam well for 55 minutes, while Coal from Dearee on the Soan, supplied by Mr. Ravenshaw, would not keep up steam. Three maunds of Moulmein Coal were next tried, but though it burnt briskly, the quantity was too small to allow of an accurate experiment. Equal parts of Cherra and Dearee Coal were then mixed, and found to keep up steam well, as also a sample, consisting of 5½ maunds, of Mr. Erskine's Adji Coal.

5. Captain Johnston remarks that two principal objects were to be attained by the above experiments. First, to try the quality of Mr. Erskine's Coal, with the view to ascertain whether that gentleman would be warranted in working his mines; and, secondly, whether Mr. Ravenshaw's Dearee Coal, mixed with Cherra Coal, would be an economical fuel.

The

The quantity tried of Mr. Erskine's Coal, Captain Johnston thinks, was too small, and therefore the experiment, though promising, was unsatisfactory. With regard to the mixed Coal, although it kept steam well up, Captain Johnston thinks it would not be economical, and therefore recommends the Dearee mines to be discontinued.

6. The above memorandum seems to have been addressed to the Marine Board, and to detail experiments proposed in the first paragraph of the Proceedings of the Committee, 8th February 1841, with a view of submitting to decisive experiments the fitness for purposes of steam navigation of a mixture of Cherri Ponji and Dearee Coal. The Committee think, that as the Government have gone to considerable expense in regard to Palamow and Dearee Coals, and as the Revenue and local officers have interested themselves greatly in the pursuit, and that upon principle it is always desirable, as well as satisfactory, to parties sending samples of Coal, that the experiments should be made by the Committee collectively; they are not, therefore, prepared altogether to discontinue the Dearee mines, or their researches, for a still better Coal, in a quarter so advantageously situated to supply the Dinapore station, and for the reason above assigned, determine to submit the mixed Coal to another experiment before the Committee, conformably to their resolution in the first paragraph of their proceedings for February last.

Remarks of the Committee.

7. A specimen of pipeclay, from the vicinity of Singmaree, in the Caribari Hills, also a white silicious and a yellow ferruginous sandy clay from the same vicinity, together with a few inferior specimens of iron ore and shale, resembling that of the Coal formation, were received from Captain Jenkins, as having been collected by Mr. Hudson.

Minerals from Caribari Hills.

8. From Lieutenant Ouchterlony nine specimens of copper, and two of lead, and one of tin ore, washed and unwashed.

Minerals from Nellore.

9. From Mr. Wilkinson the following specimens, referred to in his Report, which was read at the last meeting, were received. Soda, impure carbonate; various iron ores, as red and yellow ironstones, and ochres, gold dust, compact grey manganese ore, steatite, pipeclay, &c.

Minerals from Nagpore.

At a Meeting of the Coal Committee, held at the Honourable Company's Dispensary, on July 1841.
5th July 1841,

Present:—C. W. Smith, Esq., President; Major Forbes and Captain Johnston, Members; and J. McClelland, Assistant Surgeon, Secretary.

Read a letter from Mr. Hollings, of Mongheir, to Mr. Dent, Collector of Bhaugulpore, stating his knowledge of the existence of Coal a little beyond the borders of the Bhaugulpore district, and which may be conveyed to the village of Surygurra, on the banks of the Ganges, 20 miles above Mongheir, at six annas per maund, and offering, before communicating further, to become agent for the supply of this Coal for the Gangetic steamers. Mr. Dent states that Mr. Hollings would be willing to give every aid in pointing out the situation of the Coal to an agent appointed by the Government, and should the Coal turn out well, Mr. Dent thinks Mr. Hollings would deserve well of the Government.

Resolved, That Mr. Dent be informed that it will at first be requisite that the Committee be supplied with from 100 to 300 maunds of the Coal in question, when, if it prove good, and the field new and valuable, the Committee will recommend Mr. Hollings' claims to the favourable consideration of the Government; but full particulars must first be communicated to the Committee on the subject.

2. Read a letter from Captain Jenkins, forwarding Reports from Mr. A. H. Landers, Special Assistant to the Commissioner, for working Coal mines in Assam.

3. A specimen of Coal from Jaipore was presented from the Assam Company, with a note expressing the desire of the Directors that the Committee would favour them with an opinion as to its value. The Secretary was requested to examine the specimen and afford the necessary information.

Assam Coal.

The following are the results of the examination of this specimen of Jaipore Coal:—

Specific Gravity, 1.03.

Volatile matter	-	-	-	-	-	-	-	-	48
Carbon	-	-	-	-	-	-	-	-	46.2
Ash	-	-	-	-	-	-	-	-	5.8
TOTAL									100.0

This is a superior description of Coal, and if procurable from a large bed, capable of being worked with facility, might be profitably delivered at Dinapore and the other Gangetic depôts.

Doo布拉格浦 Coal.

4. Read a Report from Major Forbes, dated 2d July 1841, alluded to in paragraph 1st Proceedings, June 1841, on the quality of the Coal found by Mr. Pontet, near Doo布拉格浦. The experiment was made by Mr. Gilbert, and the result is that 4 maunds 24 seers of Rajmehal Coal is only equal to 3 maunds 5 seers of Burdwan Coal. The sample was evidently surface Coal.

Akyab.

5. Read a letter from Lieutenant Phayre, stating that his search for Coal in Akyab district has proved unsuccessful.

6. Read a letter from Captain Bogle, the Commissioner of Arrakan, who with reference to the resolution in the second paragraph of the Proceedings of the Committee, 5th April 1841, has entertained a Mr. H. Adams to superintend the raising of Coal at Kaung-dying, at a salary of 100 rupees per mensem. Resolved, that the employment of Mr. Adams be recommended to the approval of Government, as a temporary arrangement.

On the importance of thin seams of Coal.

7. A letter from the Government, in the General Department, dated 16th June, was laid before the Committee, together with its enclosure from Mr. Richard Boodle, dated Radstock, 12th September 1840, accompanied with sample of Coal on which the Government require information from the Committee as to whether similar seams of Coal, when favourably placed, might not be worked with equal advantages in India.

The Coal is considered as good as any in the kingdom, and supplies the surrounding country with fuel for steam as well as for domestic purposes, for lime-burning and forges, and yet the thickest bed is only 2 feet 2 inches; and the average thickness of seven different veins only 1 foot 7 inches; each vein would form a size which in India has hitherto been thought too small to work. The Secretary was requested to state the particulars regarding such beds of Coal as have hitherto been thought too small to be worked in India, for the information of the Government.

The following is a copy of Mr. Boodle's remarks:—

Radstock, 12 September 1840, near Bath.

Sir,—In compliance with the request of my friend, Reverend William Hockin, of Phillack, near Penzance, I herewith forward specimens of the different veins of Coal in the parish. The rest of the pits in this neighbourhood, such as those of Timsbury, Paulton, Midsummer Norton, Kilmersdon, Writhlington, &c., have Coal of nearly the same quality, and from nearly similar veins. I believe there is no better Coal in the kingdom for household purposes. The prices are for all haud 8 *d.* per cent., for rubble, 6 *d.*, and for half-and-half, 7 *d.* The rubble is usually good with the haud, but contains some small as well as haud, but not more than is useful in every family; I have not used any but rubble for the last 20 years; besides this, we have what is called small Coal, sold at 3 *d.* per cent., and is inferior to the other in quality, in consequence of containing some portion of dirt or chippings of the cliff, which is mixed with it by the miners in getting the Coal. This is chiefly used for burning lime, but I believe is not used for steam engines. A considerable quantity of this rubble is sent up by canal to Reading, and used in steam engines. In the neighbourhood at Vobster, about six miles off, there are pits of Coal of inferior quality as to household purposes, as I believe very little of it is large, but the small Coal is particularly clean, and of superior utility for smith's work, which is proved by the fact, that in all the smith's shops in our own Coal works, they use the Vobster small Coal instead of their own.

The thickness and specific gravity of our veins are as follows:—

	Thickness.	Specific Gravity.
	<i>Ft. in.</i>	
Great vein	1 10	1·269
Top little vein	1 4	1·298
Sliving vein	—	—
Little vein under the sliving	1 2	1·288
Bottom little vein	1 0	1·301
Top Bull vein	2 2	1·237
Bottom Bull vein	2 0	1·307
6)	9 6	7·700
Average	1 7	1·283

or 80 lbs. to the cubic foot.

August 1841.

I have not been able to procure any of the Sliving vein, as none is worked at this time; it burns with a brilliant flame, and consumes rapidly; therefore when they are landing it, I tell my servant to avoid it.

Our chief market is the surrounding country and Wiltshire, by land carriage and by the canal

canal to Reading and Berkshire, chiefly for household purposes, and much of the rubble for engines; and this is of equal quality, and indeed is the same Coal as the haud, only more broken in the getting.

If I can be of any service to you in procuring any other specimens, or gaining further information, I shall be most happy to do so.

I remain, &c.
(signed) *Richard Boodle.*

At the Meeting of the Coal Committee, held on the 9th August 1841,

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, Captain August 1841.
Wilson, and Mr. McClelland.

READ a letter from Mr. Erskine, stating, that having no ground to land his Coal on, it would enable him to get over one of the difficulties of first opening mines on his side of the Burdwan Coal field, if the Coal could be received from his boats on its arrival. Major Forbes and Captain Johnston thought that Mr. Erskine's Coal may be received to a certain extent, according as he can send it down.

2. Read a letter from Captain Jenkins, suggesting the employment of a common Coal-miner in Assam, and he thinks amongst European soldiers Northumberland or Welsh Coal-miners might be found, who, on the pay of an overseer in the Barrack Department, would be content to work hard and superintend coolies at Coal pits. Captain Wilson remarked that he knows several deserving men in the Artillery who have been brought up to mining, and who, if temporarily transferred in the manner proposed by Captain Jenkins, would be very useful in the way he suggests. The Committee agree as to the importance of such an arrangement if it could be conveniently effected, particularly as some disappointment has attended their attempts to obtain by private arrangements the services of miners. Assam.

3. Report of Captain Tremenheere, Executive Engineer on the Tenasserim Coal field, received from Government for the purpose of being placed on the records of the Committee, together with papers from the Governor of Prince of Wales' Island, connected with the quality of the Tenasserim Coal furnished for the use of steam-vessels in the Straits for the same purpose; Captain Tremenheere describes the locality of the Coal field and the navigation of the great Tenasserim. The Coal bed which has been worked is six feet in thickness, and appears on the bank of a stream now known as the Coal Nullah. The bed of Coal is covered at this spot merely by a few feet of shale and dips, at an angle of 24 to 29 degrees. There are several small, unworkable seams of Coal, alternating with clay, below this to a depth of 18 feet. The mine was opened from the outcrop, and consequently whatever water it contained necessarily lay in the workings, which no machinery, however perfect, could keep dry, the working being the lowest portion of the pit. The Committee regrets that it had not been consulted in the case of the Tenasserim Coal mine, or kept informed of the nature and progress of these works by the officer in charge, or the local authorities on the coast. Tenasserim.

4. The communications from Singapore on the subject of the Mergui Coal are to the effect that 620 tons of that Coal supplied to the Straits has been repeatedly discovered to evince signs of spontaneous combustion, owing, as would appear from samples since furnished to the Committee by the Marine Board, to the large proportion of pyrites it contains. Mergui Coal.

5. Read a letter from A. J. M. Mills, Esq., Commissioner of Cuttack, acknowledging the receipt of specimens of coal forwarded to him as a guide in transmitting future samples of Cuttack Coal to Calcutta for trial, that which is referred to in the Proceedings of the Committee, 3d May 1841, having proved very inferior. The cause of this disappointment is referred by Mr. Beetson to the heat of the jungles in March last, when the Coal was obtained, and to the necessity of entrusting the raising and dispatch of the sample to natives. Cuttack Coal.

Mr. Mills assures the Committee, on the authority of Mr. Beetson, that Coal, of the best quality, is abundant at Talcher and Hingolee, and that the Coal field is above 30 miles in extent, covered with their stunted jungle, and composed of various kinds of sandstone and slate.

6. Read a letter from Captain Jenkins, Commissioner of Assam, enclosing a Report from Mr. Landers on the salt springs near the Naga villages of Junkoo. Some beds of Coal appear to have also been met with by Mr. Landers in the Naga Hills, but not in situations favourable for transport.

September 1841.

PROCEEDINGS of the Coal Committee, 6th September 1841,

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Wilson, and Assistant Surgeon J. McClelland.

Bhutteeana.

READ a letter from T. T. Metcalfe, Esq., Commissioner of Delhi, in reply to the Committee's circular of 24th March last, enclosing a letter from S. G. Smith, Esq., Officiating Superintendent of Bhutteeana, stating that an inferior iron ore, derived from mines within two miles of Ferozepore in that district, is used in the manufacture of iron for agricultural implements.

About 10 maunds of the ore reduced to fragments of one and a half tola weight is mixed with 11 maunds of charcoal and exposed to heat for 21 hours, yielding from one and a half to two maunds of iron.

Ferozepore.

A better iron is produced from a mine at the village of Caloonee, five coss from Ferozepore, in the Ulwur jurisdiction, the ore of which yields, by a similar process, six seers per maund. It has been reported to Mr. Smith, that hot springs impregnated with sulphur occur in Sanah, and that sulphur is a product of that vicinity.

Nerbudda.

2. Read a letter from Dr. Spilsbury, surgeon to the Governor General's Agent, Nerbudda Territories, accompanying specimens of the rocks, &c., of the Coal beds situated in the Nerbudda river, between Lemata and Felwaree Ghats.

Jubbulpore.

The bed of Coal in this situation is only approachable towards the end of the hot weather when the river is lowest, at other times the site is inundated, but there are other situations in the vicinity from which Coal is now obtained by the inhabitants of Jubbulpore at any season. A sketch of these localities, exhibiting the peculiarities of the place, accompanies Dr. Spilsbury's letter.

Chittagong.

3. Read a letter from H. Ricketts, Esq., Commissioner of Revenue, Chittagong, enclosing a communication from Mr. Sconce, Collector of Chittagong, stating that specimens of a coal-like substance, which burns to ashes, emitting a bituminous smell, were some time since found in the bed of a nullah, flowing from the east face of the Seetakoond Hill, and which joins the Holdah, a large river that runs into the Kurnodoolie river, five miles above the town.

The secretary was desired to thank Mr. Sconce for this interesting information, as well as to request specimens of the mineral in question which Mr. Sconce proposed to forward. Mr. Sconce also mentions that the tribes inhabiting the hills east of Chittagong, derive their salt from the brine springs. Mr. Sconce was desirous of being informed how the existence of salt springs effected the prospect of finding Coal in their vicinity.

The secretary was desired to communicate with Mr. Sconce on this subject, and explain that the saliferous marls which contain salt springs occur in Europe, resting on the Coal formation, and that as far as we yet know, the same relative position between the Salt and Coal formations holds good in India. No limestone has hitherto been found at Chittagong, much to the disadvantage of the district.

4. Read a letter from Messrs. Gillanders, Arbuthnot and Co., accompanying a sample of Kennel Coal, imported from the Clyde, which is said to be of very superior quality, and which they think may be useful for comparison with other Coals, at the same time expressing a wish to be supplied with a copy of the Committee's Report on the quality of the same, which was ordered to be furnished.

Mergui Coal.

5. Read a letter from C. B. Greenlaw, Esq., Secretary to the Marine Board, transmitting the copy of a letter from Captain James Ramsay, Deputy Assistant Commissary General, on the spontaneous combustion of Mergui Coal, at Singapore, together with a sample of the Coal in question after incipient combustion had taken place, and requesting, in case no portion of Mergui Coal has been already analysed, that the specimens now sent may be examined, and the result communicated for the information of the Board.

The Committee observe on this subject that the experimental working of Mergui Coal has not been carried on under its direction or advice. In reply, the secretary was, however, directed to inform the Marine Board, that the tendency to spontaneous ignition in the Coal in question, appears to be owing to the presence of pyrites, a common ingredient in certain seams of Coal in most Coal fields. That the yellow shining substance may always be detected on the surface of the fracture. Specimens presenting such appearance are known to colliers as Brassy Coal, are generally of local occurrence, and should always, when they are found, be rejected at the pit. Pyrites often abounds most at the partings between the alternate layers of shale and Coal; and from samples of the Mergui Coal which came under the experiments of the Committee, it would appear probable that several seams of thin Coal and thin bituminous shale, closely resembling Coal in appearance, were worked as one thick seam of Coal, and the pyritous parting shale and Coal thus mixed together.

Chota Nagpore
Superior Coal and
other valuable
minerals.

6. Read a letter from Major J. R. Ouseley, the Governor General's Agent, Chota Nagpore, in reply to the Committee's letter of the 25th March, stating that in making the new road, he has found an immense field of Coal, about nine or ten miles south of Hazaree Baug, from which specimens will shortly be sent, some of which Major Ouseley thinks will be

be found equal to the Hosingabad Coal, pronounced at Bombay to be far superior to any Scotch or English hitherto known.

Major Ouseley states that he has also found Coal in great quantities in the Behor river, as well as close below the table land of Mynpok Surgooja, and in the Hustoo river, still more to the westward at Koorba, near Ruttonpore, in Chutteesgurh, of a very valuable kind, and laid open by the river to a vast extent. In the Behor river these extensive beds of Coal which lie in the direction of the direct route from Calcutta to Bombay, are applied to no use whatever by the natives, who are ignorant even of its combustible qualities.

An iron ore of fine quality, of which very good steel is made by the natives, also occurs in the same direction. Major Ouseley thinks, that in the hands of skilful people, the washing for gold in the sands of the Mahanuddee, might be turned to very profitable account. Gold is also found in the Brahmeny River between Midnapore and Sumbulpore. Diamonds of much value are occasionally found by the gold-washers, particularly in the Ehee river, which is supposed to be the source of diamonds in this quarter.

The secretary was directed to enter into communication with Major Ouseley, as to the best means of bringing the minerals referred to into useful operation.

7. Specimens of a superior description of red chalk or reddle were received from Captain Jenkins, as having been found by Mr. Bedford in the vicinity of Caribari Coal.

A Meeting of the Coal Committee was held on Monday, the 4th of October 1841, October 1841.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; Assistant Surgeon, J. McClelland, Junior Member and Secretary; and Captain Bogle, Commissioner of Arrakan, Visitor.

The reply of the Government* to the proposition contained in the 3d paragraph of the Proceedings of the Committee for August 1841 having been read, the Committee came to the following resolutions with regard to the employment of miners.

The Committee refer particularly to two Coals on the Island of Ramree, Kaeng Dyng, and Hoong, respecting the quality of which they have already reported favourably, the one as being the best sample of Coal hitherto met with in India, and the other a good serviceable Coal; while both appear to be most favourably placed for transport, near navigable creeks but a few miles from the coast.

Captain Bogle, who attended the Committee, stated his desire for a practical working miner in the first instance, and if, after a fair trial on a small scale, the Coals were found to answer, measures could then be had recourse to for putting the establishment on an improved footing, according to the extent to which it might be necessary to extend the operations, to guard against the chances of sickness and the consequent loss of another season. It was suggested that two miners should be sent to Arrakan, provided with all the necessary implements for working the Keang Dyng and Hoong Coal beds, so as to arrive at their post by the 15th proximo.

Recommendations of the Committee relative to Arrakan Coals.

2. The Committee recommend in detail the adoption of similar measures with regard to Assam, with a view to ascertain the expense at which the best Assam Coal could be furnished to the nearest accessible stations along the course of the Berhampooter to Bengal, according to the 8th and 9th paragraphs of the Proceedings of the Committee for January 1841. The Committee in this, as in the case of Arrakan, recommend that two miners should be selected for the duty, so as to guard against the loss of time which the sickness of one might occasion, as also that they should be in Assam as early in November next as possible.

Assam.

3. With reference to the letter of Mr. Mills, the Commissioner of Cuttack, dated 4th of August 1841, and the 6th paragraph of the Proceedings of the Committee for August 1841, the Committee recommend that two miners be appointed as in the case of Arrakan and Assam, for the purpose of opening Coal mines at Talcher and Hingolee, as well for that of ascertaining satisfactorily the quality of the Coal of those districts, as well as the expense at which it may be carried down the Bramenee river to Hunsua.

Cuttack.

4. The Committee attach great importance to beds of Coal which have been brought to notice in various situations at the foot of the Rajmehal Hills, and particularly to those situated at Doobradgepore on the Burmanee Nullah, west of Moorshedabad. Regarding this Coal Mr. Pontet has declared that nothing more can be done until practical aid be afforded in working it.

Rajmehal.

The Committee, therefore, recommend that two miners, furnished with the necessary implements, be appointed with the view of opening a mine in the most desirable situation, and should the result prove satisfactory that Captain Smyth should then be directed to afford information as to the state of the Birmmany river, and the extent to which it is navigable during the year.

5. The

* Letter of the Secretary to the Government of Bengal, General Department, Marine Steam, No. 902, dated Fort William, 15 September 1841.

Recommendations
relative to Cherra
and Soan Coals.

5. The Committee conceive it to be one of its first objects to ascertain the existence of good Coal in as many different directions, where it may become useful, as possible; and after obtaining as much information as the local authorities on the spot can afford, to recommend that practical persons may be deputed at the smallest possible expense, in order to place the fact of the existence and workability of good beds beyond a doubt. To follow out these views to the requisite extent, the Committee would also recommend that two miners be placed at the disposal of the authorities in the Kasyah Hills, for the purpose of trying the workability of the Byrung Ponjee, and other beds in that vicinity, as well as under the Commissioner of Patna, with the view of fixing upon some point where the beds long known to exist on the Soan river, or its branches, might be worked with advantage. It was, therefore, proposed and unanimously agreed to embody the above views and recommendations in a letter to the Government.

Potters' Clay.

6. Read a letter from Mr. Thomason to Major Forbes, dated Agra, 21st March 1841, enclosing a specimen of clay from Bundlecund, said to be that used by Dr. Jeffreys, of Futtyghur, for firebricks and pottery, together with two specimens of a green glass manufactured at Agra. The clay appears to be of a very fine magnesian quality, and from this peculiarity as well as its compact structure, is doubtless well adapted for firebricks and crucibles.

With regard to the clay used by Dr. Jeffreys, for the manufacture of soda water bottles, the Committee consider a knowledge of its situation would be highly useful, and the secretary was therefore directed to address Mr. Thomason on this subject, with a view of obtaining, if possible, a few maunds of the clay in question, together with such information as may be available regarding the uses to which it is now applied at Futtyghur.

7. Read a letter from Mr. James Erskine to Major Forbes, in which it is stated that when searching for Coal a few years since, in the eastern parts of Sheerghur, his workmen reported that at a short distance below the surface they came to a hard rock which required stone cutters to penetrate. Below this, about 25 yards, a quicksand was reached, from which water entered faster than their means enabled them to pump it out. In other cases, after several yards of superficial soil and clay had been penetrated, they came to a very soft sandstone succeeded by something like pipeclay in different layers of various degrees of whiteness and fineness, some as white as English chalk, of which specimens are stated to be forwarded. Mr. Erskine expresses a wish to obtain boring rods, 30 or 40 feet in length, for which he would gladly pay, in order to extend these inquiries. Mr. Erskine also states that 20,000 maunds of Adji Coal have been delivered by him at Cutwa, during the present rains, and only 5,000 maunds of what he had raised with the intention of dispatching by this channel, remained to be forwarded at the date of his letter.

It was stated by Major Forbes, Captains Johnston and Wilson, that several boat loads of Damoda Coal, lately received from Mr. Erskine, had turned out of a superior quality, after trials of samples of 300 maunds each in the Mint, Cossipore, and Steam Department.

Adji River.

8. Read a letter from G. Boscawen, Esq., to the Secretary of the Committee, dated 30th September 1841, offering suggestions for improving the navigation of the Adji, by means of three or four sluice gates at situations where the river is sufficiently narrow to admit of their construction. Major Forbes remarked that the great breadth of the stream and the velocity and body of water which passes down it during the rains, would render Mr. Boscawen's plan impracticable, or, at least, more expensive than a canal holding six feet of water formed in a direction nearly parallel to the stream.

November 1841.

A Meeting of the Coal Committee was held on the 8th November 1841,

Present:—Major Forbes, Captain Johnston, Captain Wilson, J. McClelland, Secretary.

Iron ores.

Read a letter from the Government, No. 977, dated 13 October 1841, requesting information as to the experiments made in smelting iron ores at the Mint or the Cossipore Foundry. Major Forbes informed the Committee that arrangements are now in progress which will enable him to complete the new furnace and render it available for the experiments on iron ore.

Captain Wilson submitted to the Committee a memorandum detailing the following experiment on Tavoy iron ore at the Cossipore Foundry: 26 cwt. of the ore, broken into small pieces, was put into the coaking oven, with a like quantity of English Coal, on the 7th April, at half-past 2 p.m., and taken out 9 a.m. on the 10th. A strong sulphureous smell came from the roasted ore.

Experiment on the
reduction of Tavoy
Red Ironstone.

The 20 cwt. of ore and 20 cwt. Coal yielded 32 cwt., united with coke and roasted ore. Sixteen hundred weight of this, with 5 cwt. of limestone as a flux, was put into the cupola, and subjected to the blast for three hours and a half; a good deal of slag ran off at first, but the outlies being small soon got clogged up.

The cupola being tapped, no metal ran from it, but on being opened, a mass of iron mixed

mixed with scoria was found at the bottom of the furnace, weighing 2 cwt. 3 qrs. This metal, when cold, yielded readily to the hammer and file, but when heated in a forge, and subjected to the hammer, crumbled to pieces.

No further experiment was tried, as the cupola was found to have been considerably injured by the above experiment, and being of small capacity, was unfit for the purpose.

Cossipore, 6 November 1841.

(signed) A. Wilson, Captain,
Officiating Superintendent of Foundry.

2. Read a letter from the Government forwarding a Report from Captain G. B. Tremenheere, Executive Engineer, Tenasserim Division, on the tin grounds and manganese beds of the Mergui Province. Tin is said to have been formerly worked in the Mergui Province to considerable extent, and is chiefly found, Captain Tremenheere states, in the beds and banks of streams issuing from primitive districts. The principal tin streams are on the little Tenasserim. Captain Tremenheere found that two men accustomed to the operation of washing collected 25,406 grains of per-oxide of tin, equal to 2 lbs. 963·232 grains of pure tin in half a day. The price of labour is six annas per *diem*, and the price of tin is 4*a.* 4*p.* per lb. at Mergui. Stream tin.

3. The existence of black oxide of manganese, Captain Tremenheere states, was brought to his notice in the bed of the great Tenasserim, near the mouth of the Therabuen stream, by Mr. T. A. Corbin, Assistant to the Commissioner, and a specimen of the same mineral from the Khuggoo river was also brought to Captain Tremenheere by a Kureen. The localities in which these minerals were found are all laid down upon a map which accompanied Captain Tremenheere's Report. Black oxide of manganese.

4. It is stated that the price of labour is high in the Tenasserim Provinces, a drawback which will however correct itself, the price of provisions being low. The specimens of minerals which accompanied Captain Tremenheere's Report not having reached the Committee, they cannot form an opinion of their value. The small quantity of black oxide of manganese, used in India with chloride of lime as a disinfecting agent, is imported from Europe at the invoice cost of 2*d.* per lb. Should the Mergui article answer as a substitute, it will be unnecessary longer to import this mineral from Europe; it is also used in the manufacture of glass, a manufacture which is every day becoming more essential in India.

Major Forbes states that about seven years ago a large quantity of the black oxide of manganese was forwarded to Calcutta from Ceylon, and a portion of it was sent to Mr. James Prinsep at the Mint for experiment.

Captain Johnston thinks it desirable that the greatest publicity be given to these papers.

5. Read a letter from J. Hannington, Political Assistant, to Major Ouseley, Agent to the Governor General for Territories, forwarding the following list of specimens:—

- No. 1. Decomposed felspar, from Purgunnah Pateoom.
- „ 2. Red ochreous earth from ditto.
- „ 3. Ditto, ditto.
- „ 4. Talcose clay from ditto.
- „ 5. Ditto ditto.
- „ 6. Yellow ochreous earth from ditto.
- „ 7. Inferior iron ore from ditto.
- „ 8. Ditto of better description, ditto.
- „ 9. Very superior iron ore from ditto.
- „ 10. Decomposed felspar clay from ditto.
- „ 11. Red ochreous clay from ditto.

Minerals from
Manbhoom Chota
Nagpore.

6. Read a letter from J. Thomason, Esq., stating that the clays referred to in the proceedings of the last meeting, came from near Puannah, in Bundlecund, referring for further information on this subject, as well as the manufacture of glass and pottery ware, to Mr. J. C. Pyle, now at Futtyghur, as well as to Mr. Dodd, Assay Master, Agra, and also to a correspondence on the manufacture of pottery between the Supreme Government and the Government of Agra, which correspondence has since been received by the secretary for publication in the “Calcutta Journal of Natural History.” Potters' Clay.

A Meeting of the Coal Committee was held on Monday, the 6th December 1841.

Present:—C. W. Smith, Esq., President; Captain Johnston and Mr. McClelland; Major Forbes was prevented by indisposition from attending.

READ a letter from Major Lister, Political Agent, Kasyah Hills, in reply to the Committee, stating that the Cherra Coal is capable of being delivered in Calcutta by Government agency, at 7*a.* 8*p.* per maund, a price which, considering the superior quality of the Coal, is such as to render it, in the opinion of the Committee, desirable that the mines should still be retained in the possession of the Government. Rate at which Cherra Coal may be delivered.

Comparison of Adji and Damooda Coals. 2. Reports from Major Forbes on the trial of Adji and Damooda Coals were submitted to the Committee. Major Forbes found the expenditure of Adji Coal from Mr. Erskine's mine, in a 20-horse power engine, to be 27 maunds 14 seers daily, leaving 24·47 per cent. of ashes; 29 maunds 9 seers of Burdwan Coal were required to keep the engine to the same work during the same period, and this left 25 per cent. of ashes, from which Major Forbes infers that the Adji Coal is the best of the two, and as the Adji Coal may be more cheaply delivered for up-country use, this result is one of undoubted practical importance.

Extent of the Adji beds. 3. On the subject of Adji Coal an interesting memorandum was read from Captain G. Boscawen, who describes the country west of Elambazar, on both sides of Adji river, as one extensive Coal field.

Cherralea Coal Mine. Two hundred maunds of Coal were delivered to the Committee by Captain Boscawen for trial; this sample was raised by himself from a mine, the property of Mr. C. Hollings, which is situated at a place called Cherralea, about a quarter of a mile from the west or left bank of the Adji river, about 13 miles above Mr. Erskine's mine, and about 80 miles from the entrance to the Adji river at Cutwa.

The mine is situated about 40 feet above the bed of the river on the side of an eminence, and the thickness of the bed of Coal is about six feet, and only 13 feet from the surface, covered merely by a bed of clay and "hard rocky stone." Captain Boscawen laid the Coal bare, having removed the superincumbent clay and stone for an area of several yards, and having raised the Coal, amounting to about 5,000 maunds, he then carried an excavation downwards to a further depth of 23 feet, or about 40 feet from the surface, and found several thin seams of Coal about one and a half to two inches thick, alternate with beds of shale and sandstone. A sketch of Captain Boscawen's plan of working the mine is herewith attached.

Mahuddunugger Mine. At Mahuddunugger, in an east-north-east direction, on the opposite or north-eastern bank of the Adji, and about three-quarters of a mile from the stream, Captain Boscawen states there is a bed of Coal 13½ feet thick, with only six feet of hard clay on the surface. In the vicinity of this mine Captain Boscawen states that large quantities of iron ores occur; this is melted by the natives and manufactured on the spot into all manner of mining implements, which Captain Boscawen found to be of better quality than any procurable in the Calcutta Bazaar.

Boats of 200 maunds can ascend in the rains as high as Elambazar, and make six or seven trips in the season, and if a road were constructed from Elambazar for about 15 and 20 miles, and rendered fit for hackeries, this important Coal district would thus be thrown open. It was ordered by the Committee that about 20 maunds of Captain Boscawen's sample of Coal should be tried in the Laboratory of the Honourable Company's Dispensary, and the remaining 180 maunds divided equally between the Mint and Cossipore Foundry for trial, and reports on the result made to the next meeting.

Borneo Coal. 4. Two samples of Coal from the Island of Borneo, together with a letter from Government in the Political Department, enclosing extracts of correspondence from the Governor of the Eastern Settlements on the subject, and requesting a Report from the Committee as to the quality of each sample. The Coals are stated by Mr. Bonham to exist on two small islands in the Borneo river called Pulo Chirring and Pulo Keng Arrang. The first of these consists of about half a maund of pure good coal.

Specific Gravity, 1·22.

Pulo Chirring Coal.	Volatile matter	-	-	-	-	-	-	-	-	64
	Carbon	-	-	-	-	-	-	-	-	32·5
	Ash	-	-	-	-	-	-	-	-	3·5
										100

This Coal is admirably adapted for steam purposes. It appears from the letter of Mr. Bonham that Pulo Chirring is an island within six miles of the town of Borneo, of three miles in circumference, situated in a large navigable river, easy of access, and free from danger. The Coal is found on the beach, the ebbing and flowing of the tide having removed the superincumbent bed of clay, leaving the Coal exposed at low water; it is also supposed to extend into the island, where it may be obtained by merely removing the superincumbent earth.

The Coal has been tried in large quantity on board the "Diana" steamer, and Mr. Bonham remarks that the engineer of that vessel reported very favourably of its quality.

Pulo Keng Coal. The second sample from Pulo Keng is not good Coal, but consists chiefly of the slates and shale of the Coal formation, with thin layers of Coal forming slaty layers in each specimen. One of slaty fragments of Coal from the mass of shale afforded the following result:—

Specific Gravity, 1·39.

Volatile matter	-	-	-	-	-	-	-	-	-	43
Carbon	-	-	-	-	-	-	-	-	-	30·5
Ash	-	-	-	-	-	-	-	-	-	26·5
										100

Although

Although this sample would not answer for fuel, yet there can be no question whatever of the existence of good Coal at the place from whence it was derived. Mr. Bonham refers to a small work published at New York in 1839, by Mr. Tradescant Say, and Mr. Dicken, giving an account of a voyage of the American brig "Himmaleh," in 1837, and to Mr. Brooke, a gentleman belonging to the Royal Yacht Club, for further information regarding these Coals, which, from their situation, may become of the utmost importance.

5. Read a letter from Government, accompanying specimen of tin ore forwarded to the Committee for their Report. The specimens are from four localities described in Captain Tremenhoe's Report.

The first locality near the Coal mine affords stream-tin by washing the sands of the Thangdon river, which empties itself into the great Tenasserim. The specimen forwarded by Captain Tremenhoe is a blackish grey ore, consisting of fine and rather large-grained angular particles of peroxide of tin, not quite free from magnetic iron ore and sand, but still a good ore.

Tenasserim Tin Ores.

Its value will entirely depend on the labour required to obtain it in large quantity by washing. Captain Tremenhoe states that a Shan obtained 19 ounces of the ore in an hour.

The second locality from which six specimens are furnished is on the Thabawlick, a tributary of the Thakiet, which falls into the little Tenasserim, 11 miles from Tenasserim town. Here Captain Tremenhoe states, paragraph 8, in his Report, that there is some uncertainty in the results obtained by digging and washing the sand, but that there is more certain results from looking for deposits of tin ore on the sand, and washing it out wherever it occurs. Five specimens of tin ore are furnished by Captain Tremenhoe, which have been obtained in this manner. They are all alike; fine, dusty, or sandy peroxide of tin, more or less free from sand, according to the care bestowed in washing them. The sixth specimen presents the crystals of peroxide of tin adhering to nodules of the granitic matrix. Captain Tremenhoe found that two men employed in this way obtained sufficient ore for 5lbs. 3oz. of pure tin (value R. 1. 8. 4.), at an expense of 12 annas. Captain Tremenhoe does not, however, state to what extent tin may be collected from the surface of the sands.

This point can only be settled by more extensive trials, which, as they would be attended with little or no expense, might be the more conveniently made.

Four other tributaries of the little Tenasserim have also been represented to produce tin. These streams were not visited by Captain Tremenhoe, but a specimen, No. 9, consisting of larger crystals of the ore, was obtained in a similar manner from one of them, the Khamaung river.

It would appear, from the number of pits that have been formed in the beds of these streams, that the former operations of the Burmese have been confined to washing the alluvial sands. There is nothing to show that mining operations for the extraction of the tin ore from the rock has ever been resorted to in this locality. Captain Tremenhoe had not time to visit the hilly district at the sources of these streams, with a view of ascertaining the extent to which tin there occurs in the rock.

At Kahun, a hill on the right bank of the great Tenasserim river, Captain Tremenhoe found peroxide of tin in a decomposed granitic vein, about 3 feet wide, and it is here that the results might, in the opinion of the Committee, become most important, under the management of an experienced miner, if such a person be procurable here. On the importance of this vein, and the prospects it holds out of being worked with advantage, the Committee refer with confidence to paras. 18, 19, of Captain Tremenhoe's Report.

6. A letter was submitted from G. F. Franco, Esq., Commissioner of Meerut, in reply to the Committee's circular of 24th March last, enclosing such information as he has been able to collect from the local officers of his division. From the Seharunpore district it is reported that no coal or iron occurs, and a small quantity of gold dust is obtained by washing the sands of some of the hill torrents, and that glass is manufactured at Rampoor from the sands found in the bed of the canal. Mr. Tonnochy, the Deputy Collector of Boolundshahur, reports the existence of kunkur large enough to be used for building and paving, and when burnt affords an excellent mortar, and Mr. Tonnochy recommends its use likewise as a manure. Chalk is also mentioned by Mr. Tonnochy to exist, but from his description it appears to be rather a magnesian clay. Carbonate of soda, nitre, and muriate of soda also exist; and Mr. Tonnochy's remarks on these subjects are considered by the Committee very interesting, and have, therefore, been transferred for publication.

Meerut.

A Meeting of the Coal Committee held on the 11th January 1842.

January 1842.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, and Captain Wilson, Members; Assistant Surgeon J. McClelland, Secretary.

READ a letter from Captain Jenkins, Agent to the Governor General of North Eastern Frontier, accompanying a specimen of specular iron ore, which he received from Major Davidson, of Goalpara, said to have been found on the Garrow frontier. Major Davidson states, that he has seen much richer specimens than the one in question, and that he under-

Superior Iron Ore.

stands it is to be had in great abundance at the foot of the Garrow Hills, and all over the plains; the Garrow who brought the specimen proposed, if necessary, to supply boat-loads of it. Major Davidson adds, that he submitted specimens of this ore to Captain Fisher, who pronounced it to be superior to any iron ore he had ever seen.

The Committee also entertain a very favourable opinion of the value of this ore, and at the suggestion of Major Forbes recommend that Captain Jenkins adopt the necessary measures for obtaining a sample, consisting of 300 or 400 maunds, as it would appear that several experiments are necessary, and that less than 100 maunds is not sufficient for a satisfactory trial.

2. Major Forbes informed the Committee that the fan blast for pig iron meltings will be ready in a few days, and before the next meeting Major Forbes hopes that the old cylindric blast will be made available for the new furnace which has been erected at the Mint for experiments on native ores agreeably to the recommendations of the Committee. When the new furnace shall have been heated two or three times, and used with a load of pig iron, it will then be ready for the experiments with the ores, which Major Forbes reports have been so long delayed in consequence of the pressure of other works.

Cheralea Coal.

3. Received a Report of experiment from Major Forbes on the quality of 203 maunds of Adjai Coal from Mr. Hollings' mine, referred to in the third paragraph of the proceedings of last month, the result of which is, that 28 maunds of this Coal is equal to 25 maunds of the best Burdwan.

Doobradgepore Coal.

4. An intimation having been received of the arrival of a sample of Coal, consisting of 130 maunds from Mr. Pontet, for trial, it was ordered by the Committee that 50 maunds should be delivered to the Mint and Cossipore Foundry and 30 maunds to the Dispensary for trial; the results of which would be required at the next meeting.

February 1842.

At a Meeting of the Committee held on Monday, 7th February 1842,

Present:—C. W. Smith, Esq., President; Major Forbes, and J. McClelland, Junior Member and Secretary.

1. WITH regard to the sample of Coal, consisting of 133 maunds, referred to in the fourth paragraph of the Proceedings of the Committee for January 1842, the following reports have been received as to its quality.

Major Forbes states in a Report made to the Committee, under date 20th January 1842, that this sample appears to be greatly inferior in quality to that formerly sent down by Mr. Pontet to the Mint, and that it would not keep up steam.

Doobradgepore Coal.

Captain Wilson reports that the Coal is of a dull brownish colour, with thin bright patches or layers, and that it is evidently a crop of surface Coal, and that 20½ maunds are required to do the work of 12 maunds of Burdwan Coal, and that it keeps up steam with difficulty. Copies of these Reports are annexed. Hence from the trials that have been made of this sample it appears to be a surface Coal, evidently from the first bed approached on sinking below the surface instead of going down to a better quality of bed, which might doubtless be found in the same locality by any one practised in working Coal. Resolved, that the result of the experiments, together with the observations respecting the Coal, be communicated to Mr. Pontet.

2. Major Forbes informed the Committee that, having now got the new fan blast in operation at the Mint, he will soon be able to commence the experiments on the reduction of country ores.

March 1842.

At a Meeting of the Coal Committee, held 7th March 1842,

Present:—C. W. Smith, Esq., President; Captain Johnston and Captain Wilson, Members; J. McClelland, Assistant Surgeon, Junior Member and Secretary.

Caribari Coals.

READ a letter from Major Jenkins, Commissioner of Assam, dated 19th February 1842 enclosing copy of a letter from Mr. James Bedford, Assistant Revenue Surveyor, together with a map of the several sites in which Coal has been discovered by him in the Caribari Hills. And informing the Committee that Mr. Bedford is now working the Coal experimentally, of which specimens have been dispatched by Dawk Bangy to the Committee.

Salkoora.

The information contained in Mr. Bedford's letter is highly satisfactory. It relates to Coal in three distinct places in the Garrow Mehaul Gundooparah, namely, Miramparah, Champageree, and Salkoora. The first of these places is marked "Coal bed discovered 1st March 1841," north of Horigong, on the map, page 71, Proc. Com. 1841. The Balajora river, leading from Horigong to this Coal, Mr. Bedford states, will at no season be navigable, owing to waterfalls within two miles of the Coal, but the road direct to Potumaree,

Potumaree, only five miles distant, is good, and from Potumaree the navigation is always open for boats of 400 to 500 maunds. The Salkoora bed is about three miles west of Mirampara, and is still more conveniently situated, being only three miles north of Potumaree, with a perfectly level road the whole way. Mr. Bedford, however, states, that should the Aceasee Nuddie and other small streams prove navigable during the rains, there will only be a few yards of land carriage from the Coal bed at Salkoora to depôts either at Jagrachur, or on any other place on the Bramaputree. The Salkoora bed, discovered by Mr. Bedford on the 7th of January last, will therefore afford the most accessible locality for Coal mines hitherto known, provided the quality of the Coal should prove favourable. On this last point the Committee must reserve its opinion till the arrival of the specimens, the dispatch of which is announced in the letter of Major Jenkins, above alluded to.

See Map Proceedings of the Committee, 1841, page 55.

With regard to the Coal beds to the east and south of Horigong on the Bunarasee river, Mr. Bedford states that he has not yet been able to collect further information than that previously furnished. (*Vide Proc. Com.* page 71, 1841.)

2. Read a letter from Major Jenkins, dated 31st January 1842, affording the following information relative to the Coal mine opened by Mr. Landers and referred to in the concluding part of the 1st paragraph of the Proceedings of the Committee, 7th February 1842. The mine is situated between two hills, one of which is called Namsang. Coal of superior quality is found extensively under both hills to the north, and on the banks of the river, but Mr. Landers cannot describe the spot more particularly. He has however, 100 maunds of Coal ready to forward to Seesagur on the Bramaputra, and Major Jenkins states that Mr. Landers in thus employing the Tablong Nagas (a rude people with whom we have heretofore had little intercourse) is doing much good, and hopes to effect a contract with them for the supply of this Coal to the mouth of the Deekho river in Upper Assam.

Namsang Coal.

N.B. This is from the vicinity of the Suffry Coal, which proved on trial at the Mint the best ever found in India.

3. Read a letter from Mr. Sconce, announcing the dispatch of specimens of anthracite found at Chittagong, and the existence of brown Coal in that district. From the specimens which accompanied Mr. Sconce's letter, the Committee hope that further inquiries on the part of Mr. Sconce will lead to the discovery of good Coal at Chittagong.

At a Meeting of the Coal Committee, held on Monday, the 4th April 1842,

April 1842.

Present:—C. W. Smith, Esq., President; Major Forbes, Captain Johnston, J. McClelland, Assistant Surgeon, Junior Member and Secretary.

A LETTER was read from Major Lister, enclosing a contingent bill for 21,003 rupees, being the cost of delivering 43,790 maunds of Cherra Coal to Dacca, Calcutta, and Dinapore, and requesting the Committee to obtain the sanction of the Government to the payment of the same. The Committee observe that the delivery of this Coal at the places above stated amounts to no more than an average rate of 7 *a.* 8 *p.* per maund, and that 3,810 maunds of Cherra Coal, delivered at Dinapore, cost only 8 *a.* 7 *p.* per maund, a rate which they anticipate will be found to be considerably below that which is paid for the supply of an inferior article from other Coal mines, notwithstanding the heavy charge on this Coal of 3 *a.* 11 *p.* per maund for its delivery into boats.

Results of extensive deliveries of Cherra Coal.

The secretary was directed to transfer the Contingent Bill in question to Captain Johnston for payment, and to convey the thanks of the Committee to Major Lister for having afforded so good an example of the importance of this Coal, and established the rates at which it may be delivered.

2. Read a letter from Captain Guthrie (Engineers) forwarding a specimen of Coal from Bikrampore in Cachar, found in a small watercourse on the side of a hill about 300 feet above the plain of Cachar, and half a mile distant from the Arang river, a branch of the Soorma, navigable for 600-maunds boats for four months in the year, and for dinghies for six months. The beds from which the specimen were found have not yet been traced.

Bickrampore, Cachar.

The following is the result of analysis of this Coal:—

Specific Gravity, 1.3.									
Inflammable matter	-	-	-	-	-	-	-	-	64.8
Carbon	-	-	-	-	-	-	-	-	32.2
Ash	-	-	-	-	-	-	-	-	2.
									100

Bickrampore Coal.

Considering that Coal in this situation would have all the advantages of the Cherra Coal without the expensive portorage, the secretary is directed to express the thanks of the Committee to Captain Guthrie, and to recommend further inquiries.

Caribari Coal.

3. With regard to the discoveries of Coal by Mr. James Bedford, referred to in the first paragraph of the proceedings of the last meeting, the secretary announced the arrival of the specimens referred to, and submits the following remarks on them. The Caribari Hills present the most convenient situation in which good workable Coals have heretofore been found in India; about five years ago Mr. Cheap, the Collector of Mymunsing, presented to Mr. Cracroft, then member of the Coal Committee, a specimen of Coal said to have been found at Chilmaree. It subsequently appeared that Mr. Cheap's specimen came from the Garrow Hills on the opposite side of the river from Chilmaree, and that the late Mr. Scott was aware of the existence of Coal in those hills. It was understood however that the Coal beds were situated several days' journey in the interior of mountains.

Thus our information continued until 1841, when Mr. James Bedford, who was employed as revenue surveyor, reported the existence of Coal in three different quarters in the Caribari Hills, within a distance of from three to five miles of water carriage over a good country for roads.

The following are the characters of the specimens he has supplied:—

Salkoora Coal.

Salkoora.—This is a dull brown earthy Coal, situated only three miles from Putumaree and the Kalo river, which is navigable to this point for large boats.

Specific Gravity, 1·3 to 1·4.

Inflammable matter	-	-	-	-	-	-	-	-	-	70·
Carbon	-	-	-	-	-	-	-	-	-	25·4
Ash	-	-	-	-	-	-	-	-	-	4·6
										100

Caribari.

This Coal burns freely, with a bright flame, and is admirably adapted for steam. The bed in which it occurs is near the surface, and from two to three feet thick.

Mirampara or Balajora Coal.

Mirampara or Balajora.—This Coal is situated five miles distant from Putumaree, with good road. The size and peculiarities of the bed, as well as of the Coal, differ but little from the last.

Specific Gravity, 1·2.

Inflammable matter	-	-	-	-	-	-	-	-	-	64·
Carbon	-	-	-	-	-	-	-	-	-	26·
Ash	-	-	-	-	-	-	-	-	-	10·
										100

Specimen from the Bunarossee river.

This sample burns with a bright flame, and is well adapted for steam. This bed is situated on the Balajora river, a tributary (not navigable) of the Kalo.

A third specimen has been also forwarded by Mr. Bedford from the bed of the Bunarossee river, another tributary of the Kalo, which has been examined with following results, although the original bed from which the specimen has been derived has not yet been found.

Specific Gravity, 1·4

Inflammable matter	-	-	-	-	-	-	-	-	-	50·
Carbon	-	-	-	-	-	-	-	-	-	40·6
Ash	-	-	-	-	-	-	-	-	-	9·4
										100

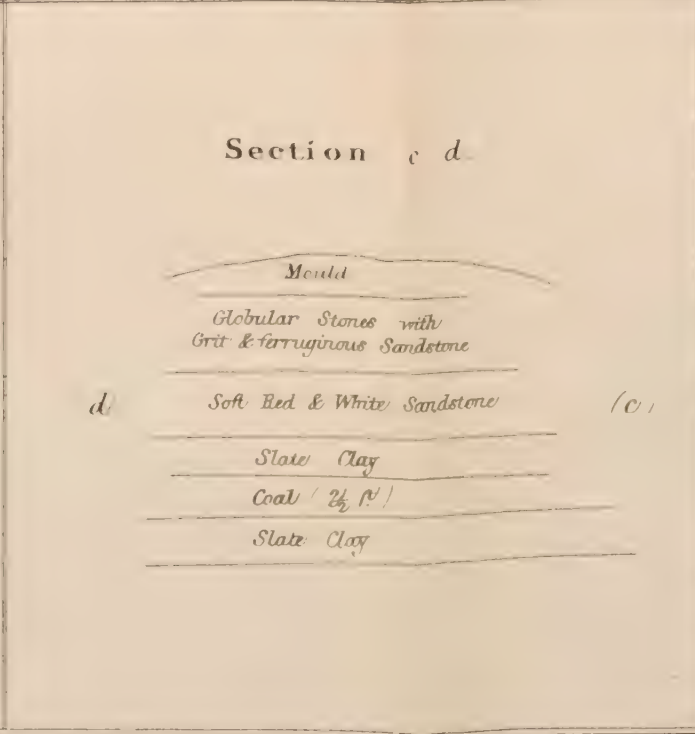
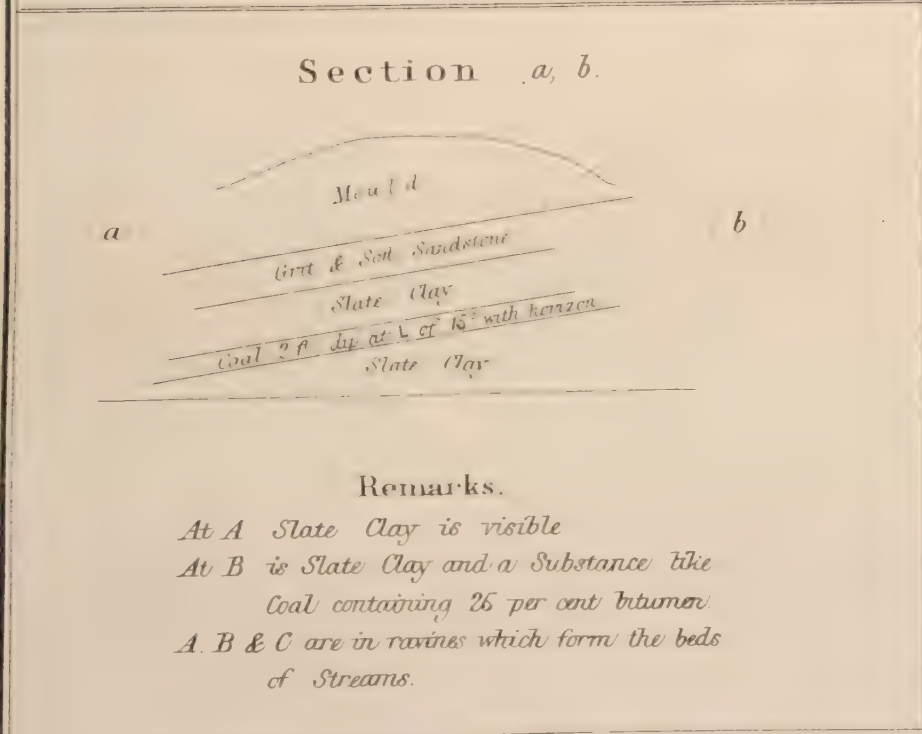
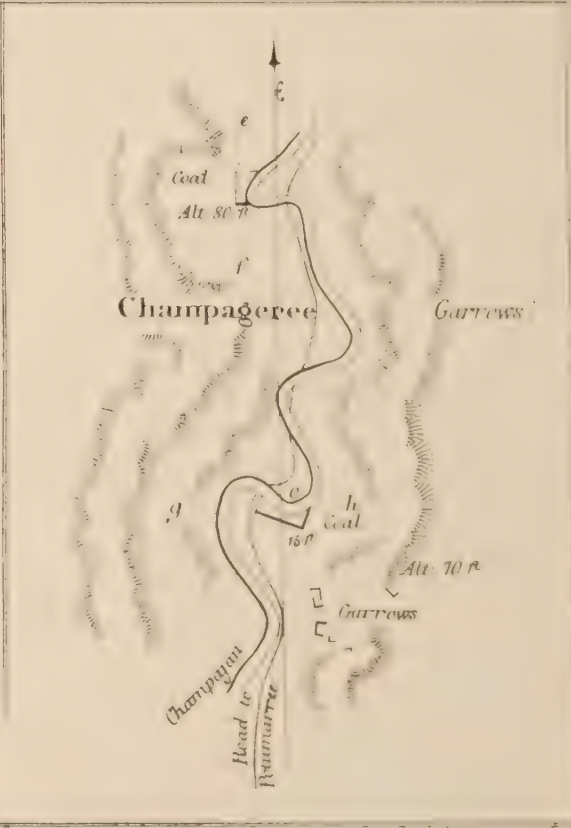
Its qualities as a fuel are like those of the foregoing.

The value of Mr. Bedford's information is enhanced by the annexed map, on which the situation of the different beds of Coal in the Caribari Hills is laid down. The existence of iron ore and useful clays has also been pointed out in this vicinity by Mr. Bedford. The secretary will be pleased to communicate the high sense which the Committee entertain of Mr. Bedford's exertions and their satisfactory result.

Gudada river.

4. Read a letter from Major Jenkins, the Commissioner of Assam, presenting a specimen of Coal from the Gudada river, which falls into the Bramaputra, opposite to Goalparah.

The



This Coal consists of a single waterworn and rounded specimen found by Mr. Bedford. It is supposed that the bed from which it was derived, is situated somewhere about Purbut Juor, to which place the Gudada is navigable for boats of 100 to 200 maunds.

The following is the result of analysis of this Coal :—

Specific Gravity, 1·4.									
Inflammable matter	-	-	-	-	-	-	-	-	57·4
Carbon	-	-	-	-	-	-	-	-	24·6
Ash	-	-	-	-	-	-	-	-	18·
									100

This is heavy Coal, ignites with difficulty, and burns without flame.

5. The secretary was directed to record an application for employment from a person named Laurence Fleming, who has been brought up to the business of working Coal mines, and would, in the opinion of the Committee, from his experience, prove a useful man in any of our Coal districts, where valuable beds are neglected for want of practical aid.

6. The President intimated to the Committee his intended departure for Europe, and requested that this communication should be entered on the proceedings.

TABLE of INDIAN COALS analysed in the Laboratory of the Honourable Company's Dispensary, from June 1841 to April 1842, in continuation of the Table, page 56, in the Reports of the Committee for 1841.

	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 parts.			From whom received.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
84	Jaipore, Upper Assam	Superior - -	1·3	48·	46·2	5·8	Mr. F. R. Hampton, 8th July 1841.
85	Pulo Chermin, Borneo	Very superior -	1·34	64·	32·5	3·5	Marine Board, 8th Nov. 1841.
86	Pulo Keng, Arreng, Borneo.	Inferior - -	1·39	43·	30½	26½	Marine Board, 8th Nov. 1841.
87	Bikrampore, Cachar -	Superior - -	1·3	64·8	33·2	2·	Captain Guthrie, Engineers, 7th March 1842.
88	Gudada River, Dhubary	Inferior - -	1·4	57·4	24·6	18	Discovered by Mr. Js. Bedford, Assistant Revenue Surveyor, 1st February 1842, received from Major Jenkins.
89	Bunarossee Caribari Hills.	Brown coal burns freely.	1·4	50·	40·6	9·4	Ditto, March 1842.
90	Mirampara, or Balajora Caribari Hills.	Ditto - - -	1·2	64·	26·	10	Ditto, March 1842.
91	Salkora, Caribari Hills	Good brown coal -	1·3 to 1·4	70·	25·4	4·6	Ditto, March 1842.

J. M^cClelland, Assistant Surgeon,
Secretary Coal Committee.

APPENDIX.

EXTRACT of a LETTER from Major *Jenkins*, Commissioner of Assam, to the Secretary of the Coal Committee, under date 19 February 1842.

April 1842.

I HAVE the honour to forward a copy of a letter from Mr. James Bedford, Assistant Revenue Surveyor, No. 69, of — January, to the address of Major Davidson, transmitting a map of the several sites in which Coal has been discovered by him in the Caribari Hills, with sections of the beds opened.

Mr. Bedford is now working the Coal at Salkoora and Mirampara or Balajora.

Mr. Bedford's Report
on the Caribari
Coals.

"I have the honour to forward map of the Caribari Coal Districts, North of Kalo river, comprising the three localities, 'Mirampara' (or Balajora), 'Champagerree,' and 'Salkoora,' situated in the Garrow Mehaul 'Gundooparah.'"

2. As the Coal of Miramparah and Salkoora appears of the best quality, I have commenced raising 300 maunds from these beds. The vein in both these places is, however, only two to three feet in thickness.

3. I have to remark also that the Balajora will at no time of the year be navigable, owing to waterfalls at Z. on the map.

4. The road from Miramparah to Pateemarree having fewer ascents than that to Harigong, the Coal raised is conveyed by land to Pateemarree (five miles), whereby the distance is somewhat increased, nine miles of shallow navigation is avoided.

5. The Salkoora bed appears the best located, as the road is level to Pateemarree Haut (three miles distant), from which place Coal can be transported by water to a depôt either at Jagrachur or Mohyndergunge; and should the streams prove navigable in the rains for canoes, there will be only a few hundred yards of land conveyance; and Coal can also be conveyed to Singheemarhi, by the Acasee Nuddie.

6. The country east of Harigong and Doomeeganee is covered with such dense jungle, that I am sorry to inform you I have not succeeded in finding the actual Coal beds, though the Coal found in the stream of Bunarosse river appears of a better kind and more brilliant colour than any in Caribari; the Coal found in the stream of Kalo River, is similar to the Mirampara and Salkoora Coal. I have no doubt, however, of receiving information in the course of another year from the Garrows.

7. The Coal found at Champagerree is very impure, but the situation, although inferior to Salkoora, is superior to that of Mirampara, owing to the road being nearly level to Pateemarree, four miles distant.

8. Globular stones, containing iron ore, are also found in the neighbourhood of Champagerree and Salkoora.

9. The hills about Domalgeree, on banks of Kalo river, are composed of pure pipeclay, and also of a white and variegated kind of clay, much impregnated with sand, but all three varieties are also found in different parts of Caribari, the best located being at Mohyndergunge, near the Burhampooter, specimens of which I have taken the liberty of sending, in case they may be deemed of any utility.

(signed) *James Bedford*,
Assistant Revenue Surveyor.

REPORT of a COMMITTEE for the Investigation of the COAL and MINERAL
RESOURCES of *India*, for May 1845, by the Secretary.

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GENERAL PROCEEDINGS, the 28th December 1836.

THE growing importance of the line of iron steamers established for communication between Calcutta and Allahabad renders it essential to consider again the means of providing Coal for their use.

Resolution.

At present, the mines of Burdwan present the only resource available for the entire demand of this Presidency, and their produce reaches Calcutta by an uncertain and difficult navigation down the Damoodur, a mountain torrent which, for more than half the year, is entirely closed. During that period the Coal remains in depôts at Ampta, whence it is forwarded into the Hoogley river in different craft from that in which it was brought to Ampta as required. The depôts along the Ganges are now uniformly supplied from this source, and are hence subject to all the uncertainty of the navigation of the Damoodur, and in case the demand for Coal at the Presidency should be more active at any time than was expected the depôts at Ampta are exhausted, and the whole supply of the capital and of the interior is at a stand until the Damoodur is again filled on the setting in of the rainy season.

This difficulty actually occurred in the past season, and great disappointment was accordingly experienced in the upper stations of the Ganges in particular, which did not receive the supplies for their depôts till long after they were required.

Such accidents will be occurring constantly as the inevitable consequence of the entire supply of Coal being drawn as at present from one spot. The Government, however, has knowledge of other mines in various parts of the territory of this Presidency more conveniently situated than the Burdwan mines for the purposes of steam navigation, and the Governor of Bengal cannot believe that means may not be found of bringing these resources also into play. The subject has heretofore attracted the attention of Government, and individuals have from time to time been deputed to search for Coal in different quarters, and their reports have been recorded, showing their inquiries to have been attended with various success. When these inquiries were ordered, the subject had not the same importance as it now possesses, under the assurance of success to the project of navigating the Ganges extensively with iron steamers of small draught, and the results of the several inquiries have never been combined for the definite purpose of showing where the endeavour to bring the Coal resources of the interior into use can be prosecuted with most chance of ultimate success.

Mr. Surgeon Wm.
Banister.
Capt. J. H. Johnston.
Captain W. N.
Forbes.
James Prinsep,
Esq.
Captain H. B.
Henderson.

Preparatory to adopting any definite measures with this object in view, the Governor of Bengal resolves, that the gentlemen named in the margin shall be appointed a Committee, specifically to consider all the information on the subject now collected at the Presidency, and to recommend what further examinations or surveys shall be ordered for the purpose, enabling Government to decide as to the best means of procuring Coal applicable to the wants of steam navigation in the interior. The inquiries of the Committee will embrace as well as the locality of the different mines of Coal explored, the descriptions of the mineral, and whether it is found alone or with iron, lead, of copper, or other useful metals in the vicinity of the mines, and likewise by what routes and at what expense in their improvement or construction it will be possible to bring the Coal to the banks of navigable rivers.

True copy.

(signed) *H. T. Prinsep,*
Secretary to Government.

LIST OF COMMITTEE FROM COMMENCEMENT.

PRESIDENTS:			
C. W. Smith, Esq., C. S.	-	-	Member of the Sudder Board of Revenue, and Provisional Member of Council. Date of appointment, 17th April 1839. Date returned to Europe, 4th May 1842.
J. W. Grant, Esq., C. S.	-	-	Keeper of the Export Warehouse, and Member of the Marine Board. Date of appointment, 10th June 1842.
MEMBERS:			
James Prinsep, Esq.	-	-	Assay Master. Date of appointment, 28th December 1836. Returned to Europe, October 1838.
Lieut. Col. Forbes, Engineers	-	-	Mint Master. Date of appointment, 28th December 1836.
Major Henderson	-	-	Deputy Auditor General. Date of appointment, 28th December 1836. Returned, April 1839.
Captain J. H. Johnston	-	-	Controller of Steam Vessels. Date of appointment, 28th December 1836.
W. Bannister, Esq.	-	-	Madras Medical Service. Date of appointment, 28th December 1836. Returned to Madras, February 1837.
J. McClelland, Esq.	-	-	Bengal Medical Service, Junior Member and Secretary. Date of appointment, 24th March 1837.
*W. Cracroft, Esq., C. S.	-	-	Judge of the Sudder Dewany Adawlut. Date of appointment, 10th May 1837. Returned to Europe, 1839.
Lieut. Col. Presgrave	-	-	Superintendent, Cossipore Foundry. Date of appointment, 17th April 1839. Proceeded to the Cape, 7th December 1840.
Captain A. Wilson	-	-	Superintendent, Cossipore Foundry. Date of appointment, 7th December 1840.
Major W. R. FitzGerald, Engineers	-	-	Superintendent Engineer of the South Eastern Provinces. Date of appointment, 10th June 1842. Deceased, November 1844.
Thomas Cargill, Esq.	-	-	Date of appointment, 16th April 1845.

* Mr. Cracroft acted as President at the request of the members, though he stood appointed merely as member.

I.—INTRODUCTION.

1. AGREEABLY with the preceding resolution, Dr. Bannister, acting as Secretary of the Committee, had just time to collect and place in the hands of the members such documents as were available in the public offices bearing on the proposed inquiry before he was recalled to Madras, to which Presidency he belonged.

In 1838 the Committee lost the services of Mr. James Prinsep.

In 1839 the Committee were likewise deprived of the services of Mr. Cracroft and Major Henderson. These vacancies were afterwards filled by C. W. Smith, Esq., as president, and Colonel Presgrave.

On the retirement of the former in 1842, and the death of Colonel Presgrave, J. W. Grant, Esq., succeeded as president, and the late Major W. R. FitzGerald as member, whose death shortly after took place.

2. The first minute in the Committee was written by Captain Forbes, 4th May 1837. It directed that the secretary should draw up the first Report, consisting of an historical and topographical as well as geological account of all that was known up to that period of the existence of Coal and Iron in India. It further directed that such information should be conveyed in a popular form, with a view to ultimate publication.

This was countersigned by Captain Johnston and Mr. J. Prinsep, and directed to be recorded for the guidance of the new secretary, who was referred to the papers in the Committee box, as well as to several reports in public offices for his materials.

3. Captain Henderson, instead of subscribing to the above, remarked, that if the papers in the Committee box were to be taken as a sample of the practical information to be found in public offices, they would have to rely more on the experience of their secretary, and the information to be elicited in correspondence with the authorities located where Coal is known to exist, than on any materials already in possession of Government, particularly as no previous inquiry had ever been entered on with the specific object now in view, except by the late Mr. William Jones. The results of whose proceedings were already before the public.

4. Captain Henderson then enumerated the following localities where Coal was known to exist, but regarding which we had little information, with the exception of what was published by Mr. Jones regarding Burdwan.

1. Burdwan.
2. Cherra Ponji and Laur.
3. Hurrah and Bagelpore.
4. Mcotee Jarma, near Sukreegullee, and Rajmehal.
5. Palamow, and on the Coile river.
6. Bidgeghur.
7. Vicinity of Hazareebag and the Benares road.
8. (Assam) under the Naga Hills, Dysung Nuddee and vicinity, worked by Mr. Scott.
9. (Assam) on the Namroop river.
10. (Assam) the bank of the Jomuna.
11. (Assam) the Noa Dihing and its affluent the Dupha Panee.
12. The Coal formation supposed by Captain Jenkins to extend to the western extremity of the Curribari Hills, near the great bend of the Barrampooter.

5. The first Report, conformably with the plan laid down by the members in the minute of Captain Forbes above referred to, was submitted to Lord Auckland

18th October 1837. It was soon after ordered to be printed to the extent of 250 copies and distributed.

Three years and a half afterwards, 14th April 1841, the subsequent proceedings of the Committee having come under the observation of the Governor General, his Lordship caused the following memorandum in his own hand to be conveyed to the president of the Committee through the private secretary, Mr. Colvin.

"These Reports are satisfactory, and much that is useful is apparently in progress and promising well; I shall presently hope for such a Report as may give a good summary of all that has been done, and as may be sent home and published here. It would, I think, be much to the credit of the Committee."

A second, more copious Report was accordingly prepared by the secretary, containing an abstract of the monthly proceedings of the Committee, with all the results attained up to April 1841. It was ordered at once to be printed and distributed to the extent of 250 copies.

In April 1842 a continuation of the proceedings up to that date was also printed and distributed amongst the mercantile houses of Calcutta.

But it was not until the present time that such a summary as the Governor General called for, could be completed in a manner at all becoming the nature and importance of the subject. If the delay that has taken place be thought excessive, it ought to be remembered, as some excuse for the Committee, that its inquiries relate to great practical questions upon which we had no previously existing experience in India to guide us.

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
6. The total outlay on account of the Committee from its institution, January 1837 to January 1845, being a period of eight years, has been Co.'s <i>Rs.</i> - - - - -	19,617	6	0
Of which sum the following items stand on the credit side:—			
	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
To Books and office furniture - - -	528	2	8
„ Mining tools - - -	886	1	6
„ Blast furnace, erected at the Mint - -	1,945	10	-
„ Adji ironstone, sent to the Mint - -	396	7	-
„ 500 maunds of limestone, sent to the Mint	250	-	-
„ 6,906 maunds of Coal, delivered to different public establishments - -	3,202	11	4
Deduct - - -	7,209	-	6
7. Leaving a total expenditure of - - -	12,408	5	6
Which sum - - - - -	4,616	10	8
was devoted to 21 months and five days' Secretary's salary, as follows:—			
To Secretary's salary from 25th March to 15th December, 8 months and 20 days, at 100 rupees per mensem - -	866	10	8
„ Secretary's salary from 15th December 1837 to 15th December 1838, being 1 year, at 300 rupees per mensem - -	3,600	-	-
„ Secretary's salary from 15th December 1838 to 1st February 1839, being 1 month and 15 days, at 100 rupees per mensem - - - - -	150	-	-
Deduct - - -	4,616	10	8
Carried forward - - - <i>Rs.</i>	7,791	10	10

	<i>Rs.</i>	<i>a.</i>	<i>p.</i>	<i>Rs.</i>	<i>a.</i>	<i>p.</i>
Brought forward - - - - -				7,791	10	10
8. Of this balance - - - - -	3,631	5	2			
have been expended in mineral surveys, as follows:—						
To Lieut. Don, for travelling charges, proceeding to examine the Coal at Sukree Gully - - - - -	83	5	9			
„ George Osborne, Esq., for travelling charges, proceeding to examine the supposed Coal at Bidgeghur - - -	240	-	-			
„ Mr. Tonkin, a Coal miner, employed in Arrakan 3½ months, at 100 rupees per mensem - - - - -	350	-	-			
„ Capt. Bogle, Commissioner of Arrakan, for expenses incurred in searching for Coal - - -	721	9	3			
„ Mr. L. Fleming, a Coal miner, employed at Rajmehal 2 months, at 50 rupees per mensem, 100; at Curribari, 10 months and 22 days, at 70 rupees per mensem, Rs. 748. 12. - - - - -	848	12	-			
„ Mr. Sweetland, to enable him to produce samples of Curribari Coal, as proposed by himself, on the assurance of his personal knowledge of its value - - -	1,387	10	2			
Deduct - - - - -	3,631	5	2			
Balance - - - - -	4,160	5	8			
9. To Postage - - - - - <i>Rs.</i> 298 6 -						
„ Freight and banghy charges „ 47 9 -						
	345	15	-			
„ Printing extra copies of first Report - - -	161	10	-			
„ Ditto 4 cancelled pages, 2d Report, 1841 - - -	10	10	8			
Deduct - - - - -	518	3	8			
Total expense of Committee for petty charges, stationery, and establishment, from January 1837 to January 1845 - - - - - <i>Rs.</i>	3,642	2	-			

10. In addition to the charge of *Rs.* 3,631. 5. 2. in the above account for inquiries regarding Coal, the expense attending the temporary employment of Messrs. Homfray and Landers might also be included, although their bills were not submitted to the Committee for audit. There is nothing on the records of the Committee to show that Mr. Homfray's deputation to Palamow emanated from it, except the following observation in the letter of the Committee to Lord Auckland, on submitting the first Report of its proceedings, 18th October 1837. "With your Lordship's concurrence, our first measure was to depute a professional miner, Mr. Homfray, to survey and report on the Palamow Coal beds, &c."

The employment of Mr. Homfray would, therefore, seem to have taken place before any regular proceedings were entered upon. I mention this particularly, as it has been since alleged that his interests in Burdwan mines were opposed to the successful object of his mission.

11. The appointment of Mr. Landers has tended to show that practical experience acquired in English Coal mines, when removed to circumstances so totally different in India, may fail to answer the desired expectation.

12. With regard to the miners, B. Tonkin and L. Fleming, who were employed with a view of supplying the demand for practical aid, which was supposed to be alone required in order to open Coal mines, Tonkin lost his health before entering on his duty, and was forced to return to England; Fleming proved of some use to Mr. Erskine in opening his mines on the Adji.

Where all the necessary previous information is obtained, and nothing remains but to commence operations, such men are useful; but in India, where the geology of the country is unknown, and the districts in which Coal occurs are unsurveyed, men of superior attainments and zeal appeared to be essential, in order to promote effectively the objects of this Committee.

13. Hence, in order to give these objects a specific and practical character, as well as to place the inquiry on a sound footing, consistent with its importance to the general interests of the country, the Committee ventured to recommend a geological survey of the Coal formation of India; or, at least, that this question should be referred to the highest scientific authorities in England.

This recommendation, we believe, has gone home, approved by the Government of Bengal; and whatever the result may be, the public interests must profit by the reference.

NOTES.

May 1837.

I HAVE collected from the Government offices all the papers on record respecting Coal, and they are contained in two bundles now circulated. The large bundle was received from Mr. Mangles, and the small one from Mr. Prinsep, and to prevent confusion, gentlemen will be good enough to keep them separate.

Each gentleman will have the kindness to forward the box to the next upon the list, and the last will be good enough to send it to me. After the papers have been circulated, perhaps it will be better to call a meeting.

(signed) *W. Bannister.*

18 January 1837.

To Capt. J. H. Johnston.
 „ Capt. W. N. Forbes.
 „ James Prinsep, Esq.
 „ Capt. B. H. Henderson.

Original Minutes,
 regulating and
 fixing the duties
 of the Secretary.

Buchanan's Reports, Southerland's on the Rajmehal and Bhaugulpore Hills, and many other Reports of a general nature, are amongst the records of Government, and ought to be read and abstracted, in so far as they relate to Coal and Iron, for the Committee's Report; and I would suggest the expediency of the secretary making an official application for those reports, in the name of the Committee. Buchanan's Reports, I have ascertained, are in the office of the Secretary to Government, in the General Department, and Southerland's, in the office of the Secretary to the Government of Bengal; and both will readily be made over to us, or our secretary. When such application has been sanctioned, the Reports of Pemberton, Jenkins, Wilcox, and other officers, on Assam, Munipore, &c., and generally all the Reports in the possession of Government, containing matters respecting Coal and Iron, or other minerals, ought also to be similarly obtained and abstracted. The first Report of the Coal and Iron Committee should contain an historical and topographical, as well as mineralogical account of all that is known, or can, through its means, be ascertained, on the subject of the minerals of India: this, as much as possible in a popular form, with a view to its ultimate publication, and as a means of attracting Indian or other capital to the speculation of working mines in the localities indicated. If the members of the Committee approve of this suggestion, they perhaps will have the goodness to correct and sign this memorandum, as a guide to the exertions of the secretary.

Mint, 6 May 1837.

(signed) *W. N. Forbes.*

I entirely concur in Capt. Forbes' suggestions, on which our secretary had better act at once.

(signed) *J. Prinsep.*

I believe the suggested measure will be productive of great good.

(signed) *J. H. Johnston.*

These

These Reports, and any others which can be discovered in the Government offices, will be of use, certainly, in preparing an historical or other account of the discoveries, and may possibly serve to direct attention to new and likely situations in which to prosecute further inquiry. But, if we take the correspondence and Reports now circulated in this box, as a sample of the practical information to be derived from any existing records of Government, we may conclude that little useful or practical benefit will follow the task of going through the papers which the offices have still to furnish us with.

Major Henderson's Minute.

The fact seems to be that no previous inquiry has ever had the precise practical object in view (*viz.*, that of working and supply) which the Government have now taken up, if we except Jones' inquiry; and it strikes me that our new secretary, whose services I am glad have been secured to us, may at once, in addition to the proposed collection of former researches, place himself in communication with the authorities and persons connected with, or in the vicinity of, the places where Coal has been discovered, and endeavour to obtain such matter-of-fact information regarding the whole of them, as may determine the Government where to direct their aid and attention, and may assist speculators in coming forward to work the places themselves.

(signed) *H. B. Henderson.*

REPORTS of the Committee that have been printed from time to time since May 1837.

1. REPORTS of a Committee for investigating the Coal and Mineral Resources of India; 8vo., G. H. Huttman, Bengal Military Orphan Press, 1838.

2. Reports and Abstracts of the Proceedings of a Committee for the Investigation of the Coal and Mineral Resources of India, brought up to May 1841, by the Secretary; G. H. Huttman, Bengal Military Orphan Press, 1841.

3. Abstract of the Proceedings of a Committee for the investigation of the Coal and Mineral Resources of India, brought up to April 1842; G. H. Huttman, Bengal Military Orphan Press, 1842.

These being now out of print, a revised and incorporated copy of the whole should be printed, together with the latest information on the subject now submitted in the present Report, May 1845.

II.—LEVELS OF INDIAN COAL FIELDS.

14. No barometrical or other measurements, with a view to obtain the relative levels and accessibility of the Coal districts of British India, have as yet been made. Improved means of transport, whether by land or water carriage, will mainly depend on such information.

15. The face of the country rises gradually from the Hoogley towards Burdwan, which is proved by the fact noticed by the late Mr. Jones, that at Omptah, 22 miles west of Calcutta, the tides in the Damooda, derived from the estuary of the Hoogley, rise only 10 inches during the highest springs in June, ebbing and flowing only half an hour. In Calcutta, on the other hand, the same distance from the sea as Omptah, there is a difference of 17 feet during the same springs, between high and low water. Hence we infer that the rise of the country westward of Calcutta, for a distance of 22 miles to Omptah, is about nine inches per mile. Beyond this the country is known to rise more rapidly for a distance of 60 or 80 miles to the Coal mines, which accounts for those violent floods which render the navigation of the Damooda above Omptah so difficult.

16. It may be supposed that the general rise of the face of the country from Omptah to the Coal mines, a distance of 80 miles, is about three feet four inches per mile, so far as we can venture to judge from the little we know of the peculiar difficulties of the navigation of the corresponding portions of the Damooda, and Adjí rivers.

Thus the elevation of the Burdwan Coal district may be supposed to be about 300 feet above the sea. But it may be suggested, as a very important practical question, whether the best description of Coal is reasonably to be expected in

the Burdwan and Adji Coal fields, without either advancing further into the hills than the situation of the present mines, or sinking to a proportionately greater depth.—See paragraph 26.

17. With regard to the Orissa district, in which the Coal fields of Talcher and Hingolie are situated, no particular mention is made of the existence of any very formidable rapids, in the accounts we have of the Bramini river.

This river is said to be navigable for 300-maund boats during six months of the year, from the coast at Hunsooa, to within 23 miles of the Coal district, the whole distance being about 120 miles.

It may, therefore, be supposed that the Coal districts of Talcher and Hingolie, are about 150 to 250 feet above the sea.

18. Again we may suppose, from the only information we have on the subject, that the Rajmehal Coal beds, situated at Doobradgepore, within 10 miles of water carriage in the rains (by means of the Burmany Nulla to Moorshedabad), are not more elevated than the Adji and Burdwan beds. The adjoining Coal beds to the north of Doobradgepore, at the pass of Patchwarry, on the Bansli river, may be a little higher.

19. The valley of Palamow contains Coal at two distinct levels, to the first of which the Coile river is partially navigable with some slight difficulty. The lower beds of Palamow Coal may therefore be supposed, in regard to levels, to bear the same relation to the Ganges at Dinapore, as the Burdwan district bears to the Hoogley at Calcutta. The second, or upper Coal field of Palamow valley is some hundreds of feet higher, cut off from the lower Coal field by an intervening ridge 500 feet high, but no exact measurements have been made. From all we know of this last Coal field, we should suppose the height to be about 500 or 600 feet above the level of the sea.

20. With regard to the Coals at Sohagepore and Singrowlie, these beds being situated above the falls of the Sone, water carriage to any great extent is out of the question. But their distance from the Ganges at Chunar, being such as to enable the country people, without roads, to bring in Coal for sale at eight or ten annas per maund to Chunar and Mirzapore, it deserves to be considered whether the supply might not be much improved on the higher parts of the Ganges from these sources.

21. East of the Ganges, circumstances as regards the general levels of the country are different, as well as the quality of the Coal itself, which is almost invariably superior to any of the beds on the western side, except Hazareebaugh, Sohagepore and the Nerbudda Coals, as accounted for para. 26.

The Coal from the eastern districts generally belongs to what is called mountain Coal, the disruptive forces to which the strata in this direction have been subject, having brought up to the surface the main Coal, without the trouble of sinking for it.

22. The chief beds extend along the south side of Assam, at intervals from the Garrow Hills to the farthest extremity of the valley; and from the former point southward, along the eastern boundary of Sylhet to Chittagong. The Coal formation throughout this course, skirts the base of the lower ranges of hills, more or less elevated from the plains, but rarely appearing near the summit of the higher mountains except at Cherra Ponji.

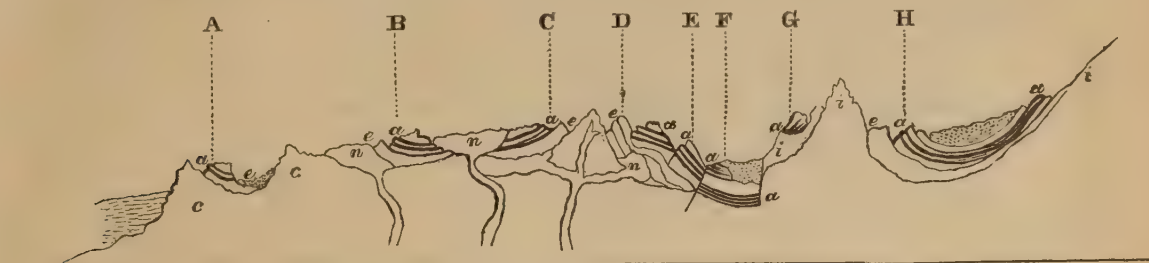
23. In Assam, as far as we are acquainted with the circumstances of the various beds, they would seem to be from 200 to 300 feet above the adjacent portions of the Barrampooter, from which they are distant generally from 40 to 60 miles by navigable tributaries.

24. The nearer situation of the Cherra Coal to the Presidency, has directed attention chiefly to it, notwithstanding its great elevation above the plains, and the consequent expense and difficulty of its delivery. Indications have been found at more accessible heights in the same vicinity, but the requisite intelligence has not yet been brought to bear on their examination, in order to determine their real value.

25. On both sides of the Ganges the Coal measures are associated with sandstone, shale, and sometimes limestone, disposed along the flanks of hills and mountain

mountains, the central masses of which are granite, presenting outbursts at intervals, forming more or less prominent elevations. One of these elevations on the western side, at the head of the Burdwan Coal field, is Purrisnath, which rises, it is supposed, to 5,000 feet, while the adjoining country consists of low table land.

On the eastern side the elevations are higher, and form continuous ridges, affording delightful climates suited to the cultivation of European productions. For the better understanding of these observations, we beg to refer to the annexed sketch, exhibiting a general section of Coal districts from Cutch to Assam.



a, a, and c, Coal Formation—*c, c, and c*, Primitive Rocks—*n, n, and c*, Basaltic and Trap Rocks—*e, e*, Sandstone Formation.

A, Cutch—B, Nerbudda—C, Sohagepore—D, Singrowlee—E, Ramghur—F, Burdwan—G, Cherra Ponji—H, Assam.

26. There is no fact better established than that the quality of Coal in India depends on the degree of disturbance to which the adjoining strata, with which it is associated, have been exposed. This is exactly what we should expect, from the circumstances of the best beds of Coal being the lowest in the series; and as in all hills and mountains the lower rocks are raised to the higher altitudes, so the lower beds of Coal are those which are projected upwards to the surface.* Hence it is due to the greater disturbance of the strata generally beyond the Ganges, that we find the Coal of our eastern districts superior to that of the districts on the western side of Bengal. The main or lower beds are, in the eastern districts, upheaved (as in the case of Cherra and Assam Coals) to the surface, where they are found as *Mountain Coal*. In the Burdwan, Rajmehal, and other low western Coal districts, the main beds of good Coal may be supposed to lie at a greater depth below the surface than has yet been reached in Coal mines of this country. But in the central table lands and hilly districts to the westward, such as Hazareebaugh, Sohagepore and Nerbudda, where the degree of local disturbance of adjoining strata corresponds with the eastern districts of Sylhet and Assam, the main Coal is brought to the surface. Hence it is that the Hazareebaugh and Nerbudda Coals, correspond with those of Assam and Cherra Ponji in point of quality, and are of the most superior description.

27. It may be superfluous to notice in this place the intermediate plains between the eastern and western Coal districts of Bengal, further than relates merely to the navigability of rivers.

The gradual rise of the country westward of Calcutta, renders the navigation of the rivers in that direction as they approach the Burdwan district, difficult, and of short duration, during the height of the rains. On the eastern side of Calcutta, on the contrary, there is a gradual depression, extending perhaps in diminished proportion to that portion of the Sunderbunds marked "Morass" on Arrowsmith's Map, a little to the west of Culnah. This admits of the general influx of tides throughout the Sunderbunds; which, together with the great rivers of the eastern parts of Bengal, affords an uninterrupted facility for inland navigation at any season, and consequent ready means for the delivery of Coal from that quarter to all parts of India.

Temporary

* Mr. Murchison observes that limestone is more prevalent in the lower beds of the Coal formation in Wales, than in the upper or newer beds. All our best Coals in Assam and the Khasyah Hills are likewise associated with limestone; while on the other hand no limestone has yet been found associated with, or in the vicinity of, Burdwan or Rajmehal Coals.

Temporary difficulties might in the first instance be felt in obtaining boats at Sylhet, on any sudden emergency, beyond a certain extent of tonnage, but these would diminish as the demand for tonnage in the district became steady, and the carriage of Coal offered a certain and profitable employment for boats.

28. The following Tabular Statement affords the result of our information as to nature and extent of the indications of Coal throughout India. It will be seen from it, that the position of 67 beds is already ascertained, affording an aggregate thickness of 466 feet of Coal.

29. A comparison of this Table with the list of sites in which Coal was supposed to exist on the Continent of India, as enumerated p. 7, Reports of the Committee 1838, will show to what extent our information on this subject has been extended since the publication of our first Report.

There is still, however, unlimited room for further improvement, for it is the nature of the inquiry to expand in magnitude and practical importance in proportion as we approach and enter into it.

ABSTRACT of COAL known in *India* 1 May 1845.

PROVINCE.	DISTRICT.	FIELD.	LOCALITY.	BED.
Tenasserim Provinces	Mergue	Little Tenasserim	Thian Khan River	a, 6 feet. b, 6 feet.
		Great Tenasserim	a, 20 miles above Tenasserim town b, above the falls	a, 6 feet. Size not stated.
	Moulmein	Lenhea River	Forty miles from the coast	Size not stated.
		Tavoy River	Not stated	Not traced.
Cuttack (Orissa)	Gopalpershad	Talchergurh	Balajora Nulla, half a mile from the fort.	1 foot 6 inches.
		Hingolee	Singra Nulla	15 feet.
Bengal	Damooda	Singharun River	A mile from the junction of the Damooda.	7 feet.
		Barracara	Burmury village	8 or 9 feet.
		Ranee Gunge	Seven miles above Singharun Nulla	9 feet.
		China Coory	Five miles above Ranee Gunge Five miles below the confluence of the Barracara River.	7 feet. 7 feet.
	Adji River	Churalya	Quarter of a mile from the south bank of the Adji.	6 feet.
		Moheednuggur	North bank of Adji, quarter of a mile from the river.	13½ feet.
	Rajmehal	Mammudpore	Two coss south of Seedpore Ghat	Size not stated.
		Bansli River	Patchwary Pass	In sandstone.
	Ramgurh	Braminy Nullah	Doobradgepore village	Numerous beds not described.
		Hurra	At Teer Mohun	Not stated.
		Mootee Jurma	Near the waterfall	Not traced.
		Bullea	In the Suncharie, a tributary of the Haharoo River.	3 feet.
Behar	Upper Palamow	Augballa	On the right side of the Benares New Road, near the 187 milestone.	Not stated.
		Village of Palamow	Coyle River, 50 miles from the conflux of the Sone.	3 feet 9 inches.
	Middle Palamow	Singra Village	a, Junction of the Amanath and Coyle River. b, Above Mirall village	a, 13 inches. b, 4 feet 7 inches. 6 feet.
		Gorassan Nulla	Five miles beyond the village of Chapari	a, 13 inches. b, 3 feet 9 inches.
	Lower Palamow	Rajhara	Sadabah River	a, 9 inches. b, 6 feet.
	Now Gong	Jomoona River	North bank, a little above the falls Dephoo Nuddee, eight miles above the falls.	a, 1 foot 6 inches. b, 2½ feet.
		Kopili River	Drifted	Not traced.
Lower Assam	Monas River	Bijnee Doar	Hills on the left bank, at the exit of the stream from the Bootan Mountains.	Not described.
		Bonarossee River	Garrow Mehals (Drift)	Not traced.
	Kurribari	Jelluadee River	a, Kooreapara Doar, 16 miles from the Burrampooter (Drift). b, Boregoomee Doar, 16 miles from the Burrampooter (Drift).	Not traced. Not traced.
		Belseeeree River	Near the village of Dymanorah, ditto	Not traced
	Tezpore	Booroolee River	a, Dikrae River, a tributary, ditto ditto. b, Booroolee Main Branch	Not traced. Not traced.

ABSTRACT of Coal known in India 1 May 1854.—continued.

PROVINCE.	DISTRICT.	FIELD.	LOCALITY.	BED.
Sylhet	Garrow Hills	Doorgapore	Undefined	Two beds, native testimony.
		Khasyah Hills	a, Lour	Not traced.
		b, Disung River	b, Near Susung	9 inches.
		c, Between Panatic and Bunsikorah.	c, Top of second range of hills	2 feet.
		d, Cheila	Undescribed	Not traced.
			a, At Cherragow	7 feet 6 inches.
			b, At Barachara	6 feet.
			a, Byrungponji	1 to 3 feet.
			b, Cheila	1 to 3 feet.
			c, Mustuk	4½ feet.
Arracan		e, Cherra	a, On the left of the Road, entering Cantonments from Mosmye.	28 feet.
			b, Facing Cantonments	2 feet.
			c, Opposite declivity	17 feet.
			d, Serrareem	12 feet.
	Cachar	Bikrampore	A small watercourse on the side of a hill, half mile distant from the Arung River.	Not traced.
	Tipperah Hills	Arpeen	Near the bed of a small stream, a sandstone rock, from which petroleum flows.	Conjectural.
	Bolonga Islands	Augne Keong	West coast of Augne Keong	a, 5 feet interrupted.
				b, 1 foot 6 inches.
	Ramree Island	Penee Keong	a, South extremity of Penee Keong	c, Very small.
		a, Kyuk Phyu	b, West coast of Penee Keong	1 foot interrupted.
Central Districts			On two small islands in front of the harbour.	A thin seam.
			In the harbour, subject to the tides	Irregular broken bed.
			a, South-western extremity	Irregular broken bed.
				a, 3 inches.
			b, South-eastern extremity	b, 20 inches.
			c, North-western side	c, 15 inches.
				8 inches.
				a, 20 inches.
				b, 8 inches.
				Masses of coal detached.
Nerbudda Valley	Sandoway	c, Koeng Dyeng	West coast of Ramree Island	6 inches bed.
		a, Kingtellie	On the beach	Numerous detached pieces.
		b, Sandoway Town	Sandstone hills, a mile from the town	18 inches.
				Not traced.
	Muggee or Paget Island.		Eighteen miles north of Sandoway	
	Chaduba Island		Not described; detached masses found in sand.	
	Ruttenpore	Hutsoo River	On low hills, at the south side	A thin seam.
	Surgooja	Manpore	Near the Fort of Koorba	200 yards thick.
	Singrowlie	Raher River	Sixteen miles south of Chergurh	3 feet.
		Kotah	Seven miles east of Burra	Many yards.
Guzerat			Mouzah	6 inches.
				b, 1 foot 2 inches.
			Sewallah Mookhe River	1 foot.
			Near Seetamadhi	Not described.
			Near Palee	Not described.
			a, Benar on the Seeta Rewah River	a, 20 feet.
				b, 40 feet.
				c, 25½ feet.
			b, At the junction of the Hard with the Sukur Rivers.	a, 1 foot.
				b, 2 feet.
Upper Assam				c, 4 feet.
				6 feet.
			a, Mardanpore	1 foot 9 inches.
			b, Boragurh	1 foot.
			Eight miles south of Bhoorda	Several beds from 9 inches to two feet.
				12 feet.
			a, Lemata Ghat	6 feet.
			b, Four hundred yards below Lemata Ghat.	
			At a depth of 70 feet	Undescribed.
			a, In the bed of the Trumboo River	Several thin seams.
Upper Assam			b, Doojapore	20 inches.
			Number River, on the west bank of the Dhunsiri.	Not traced.
			On a line between Deoza and Cham-bakotee.	Not described.
			Namsang Purbut	6 feet.
				6 feet.
			a, Tyroo Ghat	Not described.
			b, West Tyroo	Not described.
			Bed of Suffry River	a, 18 feet.
				b, 37 feet.
Upper Assam				c, 36 feet.
				8 feet.
			a, Rising ground near the bed of the river, about a mile from the village.	6 feet.
			b, Quarter of a mile from the river, on an elevation of 50 or 60 feet.	
			a, Gheerphong	a, 9 feet.
				b, 2 feet.
				c, 2 feet.
			b, One mile south of Geerphong	Several beds, size not stated.
				20 feet.
			a, Three miles or four from Old Beesa	

A S S A M.

Assam.

32. THE Coal districts of Assam, though more or less continuous, particularly along the southern side of the valley for 350 miles, may be conveniently divided into Upper and Lower, corresponding with the division of the province.

33. Bishenath, situated 170 miles from Bengal, being taken as the limit between Upper and Lower Assam, we have indications of six Coal fields above, and three below.

34. Major Jenkins in enclosing to Mr. Maddock the last discoveries of Coal in Assam, 26th February, and 14th March 1842, urges the expediency of appointing at once a well-qualified person to examine all the Coal beds known to exist in that province.

35. In reply, Major Jenkins was informed that the Governor General proposed to avail himself of the first opportunity of appointing an officer of experience and the necessary acquirements, to conduct a survey of the Coal deposits near the banks of the navigable rivers in Assam, where the best Coal is to be found in situations affording the greatest facilities for its removal by water to the Presidency. In forwarding this correspondence to the Committee, its opinion was invited.

36. A survey of the Coal beds in Lower Assam and Sylhet was accordingly recommended with the above view by the Committee.

LOWER

NOTES.

EXTRACT of a Letter from Major *F. Jenkins* to Government, 26th February 1842.

THAT his Lordship may judge of the expediency of appointing at once a well qualified person to examine all the beds of Coal known in Assam, I will briefly mention the beds yet discovered or supposed to exist.

Namroop and Namsang river falling into the Booree Dehing above Jaipoor, little is known to me of the beds in either stream, but I think the quality of the Coal is nearly the same, and Major Forbes reported on some, sent down by Lieutenant Bigge from the Namroop river, that it was the best for certain purposes of any discovered in India.

At Jaipoor there are three beds, two directly on the gorge of the hills through which the river flows. One of these the Assam Company are working, and the stratum, as far as exposed when I visited it, was six feet thick of very fair Coal, and containing apparently much less sulphur than in the first small stratum overlying that now working.

Half way to Borhaut from Jaipoor is the bed worked by Captain Hannay and Mr. Landers above adverted to. I imagine this coal is similar to that of Jaipoor and Borhaut.

At Borhaut, directly in the bed of the Disung on both sides, is a deep stratum of Coal that has not yet been worked, but the locality seems very favourable.

In the Suffery, is the Coal worked by Mr. Bruce under the late Mr. Scott's directions, and it was said to be very good. In the Disang is the bed now working by Mr. Landers.

In the Dhunsiri, Coal has been traced in several places, but we know nothing of the beds.

In the Jumoonna there is a Coal bed connected with a limestone perfectly identical with the limestone of Cherra, and there is therefore fair grounds for supposing the Coal may be of the same quality.

The last bed known on the south bank is that lately discovered by Mr. James Bedford on the Caribari estate, under the Garrow Hills, of which the Coal as far as yet opened appears inferior and earthy; but as the situation is extremely favourable, it may be worth while to go on with the operations here to some extent, in the hope of coming upon a richer stratum below. This Coal is besides connected with beds of iron ore and pottery clays that seem likely to be of much value.

On the north bank several traces of Coal have been met with from time to time, but from our recent occupation of the Doars it now seems certain that Coal will be found under the northern hills in the same manner as we have found it abounding under the southern hills, for I have lately had samples of Coal from the Gadada river, falling into the Berhampootur at Doobry, which were sent me by Mr. Bedford, and small samples from Mr. C. K. Hudson and Captain Mathie, of Coal found in the Monas and Bijnee Doar; and lastly, Lieutenant Scott showed me at Tezpore both good Coal and limestone from Koreaparah Doar, of which he would have made a personal examination, but he was driven in by a slight attack of fever.

EXTRACT of a Letter from the Government to Major *Jenkins*, 14th March 1842.

I HAVE the honour to acknowledge the receipt of your Despatch, dated the 26th ultimo, No. 29, submitting your opinion upon Lieutenant Colonel Garstin's proposal for expending a sum of 1,000 rupees in obtaining specimens of Coal in Assam, and in reply, to inform you that the Governor

General

LOWER ASSAM.

Lower Assam.

In this part of the province indications of Coal are less decided than in the Upper Assam, but being nearer to Bengal, they are on that account more important.

37. *Durrumpore*.—Beds of Coal are found in the valley of Durrumpore at the fall of the Jumoona, a confluent of the Kopili river, about 90 miles from Gowahatti, 60 miles of which is an open navigation for the greater part of the year, the remainder is navigable in the rains to the Coal beds.

38. A bed of Coal $2\frac{1}{2}$ feet in thickness is intersected by a little nullah half a mile above the falls of the Jumoona, at a distance of 80 or 100 yards from that stream.

39. A second bed occurs in this locality, the particulars of which are not yet known, but a sample of the Coal transmitted to the Committee in April 1844, proved on analysis to be one of the purest and finest Coals hitherto met with anywhere; also at a distance of eight miles above the falls, a small bed of $2\frac{1}{2}$ feet in thickness, has recently been found in a tributary of the Jumoona called Dephoo Nuddee, by Messrs. Wood and J. W. Masters. The quality of the sample furnished from this last bed is not however good.

40. *Kopili River*.—In the bed of Kopili river, 24 miles above the confluence of the Jumoona, near a place called Serga, at a distance of 10 or 20 miles to the south west of the preceding Coal, drifting specimens have been found in the sands, thereby indicating the existence of beds of Coal more or less extensive towards the head of this stream.

41. *Monas River*.—(Bonash.)—At the Bijnee Dooar, on the north side of the valley, 45 miles from the confluence of the Monas with the Burrampooter at Goalpara, and 260 miles from Bauleah on the Ganges, several thin beds of Coal were observed by Mr. C. K. Hudson, in hills on the left bank of the Monas, at its

NOTES—continued.

General in Council proposes to avail himself of the first opportunity of appointing an officer of experience, and the necessary acquirements to conduct a survey of the Coal deposits near the banks of the navigable rivers of Assam, with a view to determining where the best Coal is to be found in situations affording the greatest facilities for its removal by water to the Presidency.

EXTRACT of a Letter from Major Jenkins to the Committee, 1st December 1837.

I HAVE the honour to forward a copy of a letter No. 26, of the 25th instant, from my assistant, Lieutenant Vetch, in charge of the Durrung division, communicating the discovery of traces of Coal in three of the rivers flowing from the Bootan range through that division into the Burrampooter.

Lieutenant Vetch has not yet been able to visit the places in which the Coal has been found, but he proposes taking the earliest opportunity of doing so, and I trust his further researches will lead to the discovery of Coal *in situ*.

These discoveries of Coal on the north bank of the Burrampooter, and over a tract of country 50 miles in length, appear to me to add greatly to the importance of the previous discoveries of Coal on the south bank of the river; for I conceive it may be presumed that we have by no means yet obtained a knowledge of the full extent of the Coal beds in Assam, and that it is not improbable they are co-extensive on both sides of the valley, and will be found very nearly throughout its whole length.

The original sketch alluded to by Lieutenant Vetch I have the honour to annex hereto, and the specimens will be forwarded by dawk banghy.

From Lieutenant Vetch to Major Jenkins, 25th November 1837.

I BEG to send you, for presentation to the Government Coal Committee, specimens of Coal which I have discovered in the channels of the Ghellundee, Belseeree and Bhooroolee rivers.

The expectation entertained in my note to you, from having found the same lignites in the Ghellundee of Koorecapara as in the Bhooroolee of Chardooar, with courses about 50 miles apart, but taking their rise from the same chain of mountains that the seam from which they were washed extended along the frontier, is greatly increased by the discovery of the same lignite in the Belseeree, which is central.

Lower Assam.

its exit from Bootan, along with limestone. The place is in all respects favourable for water carriage. The size and circumstances of the beds are not described. But, with the exception of Kurribari, this is the most convenient situation in which Coal has been hitherto found in Assam.

42. *Kurribari Hills*.—Detached specimen of good Coal have been found in the beds of the Bonarasee river, a tributary of the Kalo, in the Kurribari Hills.

43. Drifted fragments have also been found on the north side of Assam in the sands of Jelluadee, and Dhunsiri, in the Kooreapara, and Booreegoomee Doars, 16 miles from the Burrampooter; also on the Belseeree river near the village of Dyamorah, 14 miles from the Burrampooter; and lastly, on the Booroolee and its tributary the Dikrau river, 17 miles from the Burrampooter, a little above Tezpore.

ABSTRACT of COAL in Lower Assam.

Province.	District.	Field.	Locality.	Beds.
Lower Assam -	Nowgong -	Jumona River	At the Falls - - -	2½ feet
		Kopili River -	Drifted - - -	2d bed not described.
	Monas -	Bijnee Doar -	Hills on the left bank at the foot of the Bootan Mountains.	Not described.
	Kurribari -	Bonarasee River	Garrow Mehals -	Not traced.

Upper Assam.

UPPER ASSAM.

44. In Upper Assam we have six Coal districts as follows :

- I. The Dhunseeree, 30 miles above Bishenath.
- II. The Dikhoo, 80 miles above Bishenath.
- III. Suffry, 80 miles above Bishenath
- IV. Disung, or Boorhath, 90 miles above Bishenath.
- V. Boree Dihing, or Jeypore, 100 miles above Bishenath.
- VI. Namroop, or Beesa, 180 miles above Bishenath.

45. In these six fields 10 beds of Coal have already been observed, and their size respectively ascertained; which altogether amounts to an aggregate thickness of 159 feet. This is probably not a third of the contents of these great Coal-fields.

46. Abundance

NOTES—continued.

I particularly beg to bring to notice the specimen marked A, found in the bed of the Belseeree, which seems to be good Coal, and to burn freely. The lignite is difficult to ignite, but when once on fire gives out a very powerful heat, and is very enduring.

As soon as I can spare time, I propose visiting the beds of these and other intermediate streams flowing into the Burrampooter, as far up their course as it is possible to proceed, with the hope of coming upon the main seam.

In the accompanying box, the specimens marked A and a, are coal and lignite found in the Belseeree river running through Chardooar, and found in greater abundance than in the other rivers. That marked B, is from the Ghellundee running through Koreahparrah; the same kind is also found in the Dunseeree (and I sent you a specimen of it some time ago), C is from the Booroolee and also Dekraee, which falls into the former.

I have also put up into the box two rather curious specimens, one of the ash of the Coal A, in which there appears to be osseous remains, and the other of lignite C, in which a knot in the wood can be distinctly seen, while a formation of iron ore has filled a crack in the same specimen.

I have information which leads me to expect the lignite in the whole of the rivers between Dunseeree, west, and Booroolee, east.

I have the pleasure to annex a rough outline of the rivers in this district, marking the places where the Coal was found, with letters to correspond with those on the specimens.

COPY

46. Abundance of clay ironstone occurs with the Coal of Assam, and is a important feature in the resources of the provinces especially demanding attention, particularly as it is the very kind of ore from which the bulk of cast-iron is made in England.

47. Thus, should the Coal of Upper Assam be available at present for no other purpose, it may at once be employed in the reduction of the iron ores which occur with it; and where both coal and ore are found together, attended with an easy water carriage to all parts of India, the result may without difficulty be made of the highest degree of importance.

48. The

Upper Assam.

NOTES—continued.

COPY of a Letter from Captain Jenkins to Captain Henderson, Member of the Coal Committee, 23d March 1837.

I HAVE just had the pleasure to receive your letter of the 11th, and, as it is a holiday to-day, I will proceed immediately to give you all the information in my power regarding the Assam Coal-fields, though I may premise that what I have to say, is more to point out the sites in which Coal has been found, than to give any description of the extent of the beds, or any details that I could hope would turn to any useful account in the present state of our information.

The first bed of Coal that appears to have been brought to notice was that worked by Mr. Scott with a view to supply the steamer intended to ply on the Burrampooter as alluded to by you. In describing its position, I must refer you to Wilcox's Map of the Eastern Frontier. The next river in that map above Rungpore, on the south bank of the Burrampooter, is the river called Disung Nuddee, and you will observe two small streams running into it from the Naga Hills; the name of the most westerly is the Suffry. The bed of coal worked by Mr. Spott is on the banks of this little nullah close under the Naga Hills; Mr. Scott employed Mr. Bruce (the Tea Plantation superintendent) to raise Coal, and Mr. Bruce sent down a few thousand maunds to Mr. Scott, but what became of the Coal I do not know, except that a small quantity was lying at the ghaut at Gowhatti when I first came to Assam. It seemed to be very fair Coal. Mr. Bruce's Report, or some account of his proceedings, will be found, I think, in the Reports on Assam, by Pemberton and myself. He found the Suffry navigable with difficulty, from the rocks which obstructed the channel of the stream, but he was of opinion, that the obstructions were readily removable. Mr. Bruce had to encounter some difficulties also from the want of population, but he had overcome these in great measure, and was in the way to provide any supply that might have been required when the experiment was closed. The Coal lay in a thick stratum close to the surface, and I think Mr. Bruce found the bed easy to work. In the immediate vicinity were iron mines, worked by the Nagas; from my recollection of the account given of these mines, the iron they yielded was a nodular iron ore imbedded in clay; and from the circumstance of the ore lying on the brink of a small declivity, there was every facility for working it. I speak now from imperfect recollection, but I will request Mr. Bruce to favour me for the Committee with an account more to be depended upon. At the source nearly of the Disung Nuddee is the old fort of Boorhath, between which and the fort of Jypore are valuable brine springs, though now made little of; they are worked by the Nagas in a very rude way indeed, some account of which you will also find in an Appendix to Pemberton's and my Reports. Mr. Bruce's elder brother had taken a farm of these brine springs, and was providing himself with the necessary iron boilers when he died, and the undertaking was abandoned.

The next bed of Coal that was brought to light is situated on both banks of the Jumooona river which falls into the branch of the Burrampooter, called the Kullung, and that rejoins the great river eight or ten miles above this. The Coal is found about half-way between "Deezooa" and the "Dissaro rivers," and little more is known of it, than that it is abundant and associated with precisely the same limestone as that of Sylhet. This Coal is good and similar to that of Cherra Ponjie. Of the extent of this field nothing is exactly known, but having lately had a specimen of very fine Coal sent me, which was picked up in the bed of the Deyong, just where it is incorrectly called "Koppelee" by Wilcox, there are grounds for supposing that between the Deyong and Jumooona there is a very extensive field of Coal, and there are some reasons for believing that it is not confined to the doab of these two rivers. The lime being known to extend to the Kopili which fall into the Deyong at the places marked Dyung, but which ought to be read Dyung Mookh; the Deyong or Dyung there losing its name at its junction with the Kopili, although the former is the larger river. The further indications which denote the probable extension of this Coal field are brine springs under the Naga Hills, at a place called Sunkur, facing the centre of the doab of the Jumooona and Dyong, and which brine springs continue to the north down the western branch of the Dhunsiri river, and are connected with lime and hot spring, while in the eastern branch of the Dhunsiri (the Dyong or Dheong) are beds of sulphurous alum slates, or rocks related nearly to the Coal strata. At a junction of these two streams of the Dhunsiri at Naga haut ("Naga pate") and for a considerable distance inland on the right bank of this river, there are iron clay ores worked, of which some account was lately given by Mr. Rae, the missionary. The Dhunsiri, Jumooona, and Dyong are small streams, but they are navigable half the year for boats of the province (canoes), and bring down large volumes of water equal to any boats in the rains. Of the intermediate country along the hills between the Dhunsiri and the Disung, I have no information, but it appears to me probable that the same formation extends throughout.

For in the late expedition of Major White, Lieutenant Bigge, Mr. Griffith, and Captain Hannay to the Patkaye Hills, in the direction of the Namroop river, they brought to light an extensive bed of Coal and several petroleum and brine springs of the Coal. I have sent samples to James

Upper Assam.

48. The manufacture of iron, if once introduced in Upper Assam, would tend greatly to settle this part of the frontier, and might draw into habits of industry the restless and uncivilised races who inhabit the districts adjoining, who appear, from the following instance, to be quite capable of improvement by such means, and upon whom the occupation afforded by working coal mines in the Khasyah Hills, as well as in Assam, has already produced some good effect.

49. Major Jenkins, in addressing the Committee on the subject of the Dikhoo Coal beds observes, 100 maunds are ready to be forwarded to Seeksagur, and remarks (alluding to the person engaged in this duty), "he is employing the Tablong Nagas, a rude people, with whom we have had very little intercourse, is doing much good, and hopes to effect a contract with them for the supply of Coal to the mouth of the Dikhoo river.*"

* See Proceedings 7th March 1842, para. 2.

No. I.—*Dhunseeree.*

50. Coal has been found in two situations on this river, which joins the Burrampooter 30 miles above Bishenath, but we are not informed of any particulars or circumstances connected with the beds.

51. The first situation at which detached fragments of good quality were found was,

NOTES—continued.

Prinsep, and I believe Lieutenant Bigge has done the same to Gordon, with a full account of what they discovered. I will call upon White and Bigge officially to give further details than I am able to furnish; I think I heard that one of the strata of Coal observed by these gentlemen was 15 feet thick. The Booree Dihing is also a navigable river.

By turning to Wilcox's account of his journey to Borkhamti, in the "Asiatic Researches," you will find that he met with Coal in the Noa Dihing and its affluent the Dupha Panee. From a consideration of all the circumstances before enumerated, I think there is reason for supposing that a very extensive coal field, or series of fields associated with other valuable minerals, extends from the Singpho Hills east, along the Naga Hills south, all the south side of the valley to the hills of Cachar, and I cannot help thinking that the same formation somewhere in the Jynteah country crosses the hills and is connected with the formation of Cherra Ponjie, and the lime and Coal of Pundua and Laour. It is certain that from Chilmari along the Caribari Hills and the Garrow and Kassiah Hills to Gowhattee, that on the northern face of these hills none but granitic formations will be found; but at the western extremity of the Caribari Hills the formation changes to laterite, and further on there is alum slate; and from some part of that neighbourhood, I once saw in Calcutta, specimens of numerous fossil remains, from which circumstance, and also from a common report, that Mr. Scott had Coal brought him from some spot in the Caribari Hills, I am led to believe that the whole of the south of the Garrow Hills from Pundua will be found to be of the same formation, and that Coal may possibly be found close upon the great bend of the Burrampooter, than which a more desirable site for a Coal bed could scarcely be imagined for the supply of steamers coming through the Sunderbunds, and for the general demands of the eastern part of Bengal.

On the whole, I think it highly desirable that we should at least try to know what actually does exist, and I should recommend your Committee to endeavour to prevail on Government to appoint a well-qualified person to survey all the south of the Garrow Hills from Chilmari to Cherra Ponjie, and from thence to cross through Jynteah to the Cachar Hills, and fall down the Kopoli; and, after examining all the country on the banks of the Dyong and Jumoona, to proceed to the Dhunsiri, and thence upwards under the hills all the way to Sadiya. Much might be done in one season if he is at his starting post early; and I should recommend his being at Cherra by the 1st October at latest; he could then immediately and safely proceed to examine all the ground above the ghats as far as Laour or Soosung, and by the 1st of November he would be able to descend and examine the lower hills round the Chilmari; from thence he should return again to Cherra, and keep on the high ground until he falls in with the bed of the Kopoli, which, in about 92° 30' E. Long., he will fall in with, running nearly S. and N. to Dyong Mookh. By taking this course he will, I think, undoubtedly ascertain whether the Coal formations cross the hills or not.

I have said nothing of the geology of the north bank of the Burrampooter, for in fact I know nothing of it; and the country is nearly inaccessible from the misrule of the Bhooteahs, and the rudeness of Duphas and Abors who inhabit the lower northern hills; but there is nothing in the state of the south bank that will prevent a full examination of all the border hills, except that our protégé Poorunduz Sing has a feud with the Nagas, but they would not molest any English gentlemen, accompanied by half a dozen of our sepoy, and whose pursuits were peaceful.

I think I have given you all the information I recollect, but if anything else occurs to me I shall not fail to address you again. I am exceedingly anxious to know what mineral resources we do possess in this province; and as I trust to get assistance from your Committee in prevailing on Government to send us a competent geologist to report on what we have already got imperfect traces of, I shall not be backward in laying before the Committee all the information in my power to induce them to second my application.

EXTRACT

was in the bed of a small stream called Nambar, which falls into the Dhunseeree from the west, at a distance of about 30 miles from the confluence of that river with the Burrampooter.

52. The second locality in which specimens were found in the vicinity of this river is stated to be in a line between Dezooa and Chumakotee, where the mineral is said to occur in large quantities.

53. In communicating specimens from these sites to the Committee, Major Jenkins observes that they confirm previous indications of the existence of extensive beds on the banks of the Dhunseeree, which is a large and more manageable river than either the Dihing or Disung, on which valuable beds of Coal also occur.

ABSTRACT of COAL on the Dhunseeree.

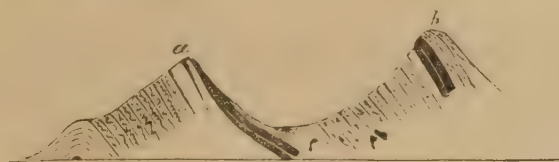
Province.	Field.	Localities.	Beds.
Upper Assam	Dhunseeree	Nambar - - - - - On a line between Dezooa and Chambakote.	One not traced. Two not described.

No. II.—*Dikhoo*.

54. This Coal is situated on the Dikhoo river, 80 miles above Bishenath, and 35 miles from the confluence of the Dikhoo river with the Burrampooter. Two beds of Coal have here been observed on the western bank of the river, a little above the rapids.

55. In the Namsong Hill, a bed of very superior Coal occurs, six feet in thickness. It was first opened by the Government, and subsequently worked to some extent by the Assam Company, for the use of their own steamer, the commander of which certifies to its being the finest Coal he ever used.

56. The second bed occurs in another hill bearing a short distance south of the Namsong. In order to make the thing clear, the relative situation of these hills, and the circumstances of the Coal, are exhibited in the annexed figure, as we understand the case to be from imperfect descriptions. The size of these beds is not expressly stated, but they are supposed to be each about six feet.



57. Other

NOTES—continued.

EXTRACT of a Letter from Lieutenant *Brodie*, 9th May 1837, to Captain *Jenkins*.

PIECES of Coal of good quality were picked up by myself in the bed of the Nambua, a small stream running into the Dhunseeree from the west; near the place where Coal was found in the Nambua is a rock of limestone, which extends across the river.

EXTRACT of a Note from Captain *Jenkins*, 12th September 1839.

I SEND you a lump of Coal from a new site near the Dhunsiri, which I shall be obliged by your giving me an opinion of. It has been found, I understand, in large quantity, and near the banks of the above river, in a line between Dezooa and Chamakote of the Nagas, not far from the tract of tea lately found to exist in that quarter.

Upper Assam.

57. Other beds are stated to exist on the eastern bank of the river, but particulars are not stated.

ABSTRACT of COAL on the Dikhoo.

Province.	District.	Locality.	Beds.
Upper Assam - -	Dikhoo - - -	Namsang - - -	6 feet. 6 feet.

SUFFRY and DISUNG.

58. The Disung river enters the Burrampooter near the mouth of the Dikhoo, but takes a more oblique course along the foot of the lower range of Naga Hills. On one of its branches, the Suffry, a tributary falling into the Disung, at a distance of about 30 miles from the confluence of the main river with the Burrampooter, Coal has been found at several points, as well as on the main branch of the Disung itself, at Boorhath, about 20 miles above the confluence of the Suffry.

No. III.—*Suffry*.

59. The Suffry river extends in a south-westerly direction for a distance of 18 miles towards the Diko Coal fields, and in this course intersects several large beds of Coal.

60. *Lower Suffry beds*.—At a distance probably of six or seven miles from the confluence of the Suffry with the Disung river, several beds of Coal, no less than eight, were observed by Mr. Bruce to intersect the stream and the banks of this river.

NOTES—continued.

From Captain *Rogers*, Hon. Secretary to Assam Company, 25th January 1845, to Secretary of the Coal Committee.

THE trial made by the Assam Company of the Coal mines in Assam was limited to about 1,000 maunds. The mine was originally opened by the Government at the foot of the Namsang Hills, which abound with Coal of the finest quality. It is now probable, from the rapid success of our tea manufacture, that a steamer may soon be employed by us in Assam, when the Coal will be found most important.

From Mr. *Smith*, Commander of the Assam Company's Steamer, to Captain *Rogers*, Hon. Secretary of the Assam Company, 24th January 1845.

I HAVE great pleasure in informing you, that the Coal I received at the Diko river was the best I ever had on board a steamer, generating steam quicker without clinker, and far superior to any Coal in Calcutta.

EXTRACT of a Letter from Mr. *A. H. Landers*, Special Assistant to the Commissioner.

"THE upper strata of Coal is six feet high, clay forming the roof. The bed dips at an angle of 40 degrees, and buries itself so as to prevent me from tracing it above 100 yards. I am certain it could be worked at a trifling expense."

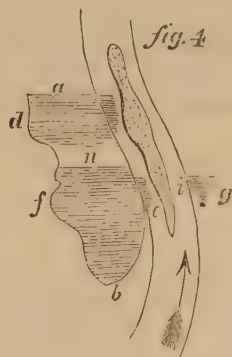
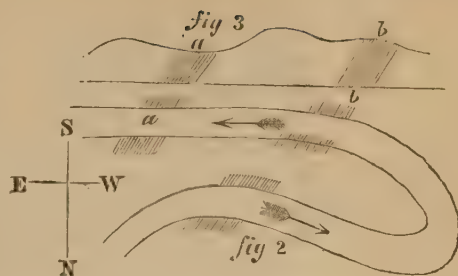
Limestone, Mr. Landers had reason to believe, occurs under the Coal. Another bed of Coal was pointed out to Mr. Landers on the very top of Namsang Purbut, bearing south, but size and distance are not mentioned.

Letter

river. The annexed figures are reduced from a drawing by Mr. Bruce of one situation in which the bed of the river, Fig. 2, is intersected in three places by great seams of Coal, which are also seen rising up into the bank, Fig. 3. The bed, *a*, is said to be 12 cubits or 18 feet in thickness, and the bed, *b*, is 25 cubits or 37 feet 6 inches. Mr. Bruce raised a quantity of Coal here from these beds at their projecting points; but, having been acted upon by the water, he did not think it of such good quality as the following.

61. Half a day's journey further up the river, or probably three or four miles at the utmost, the navigation is very difficult. Mr. Bruce came to a bed of Coal 24 cubits or 36 feet thick, or rather, as would seem from his drawing, two beds separated from each other by a thin band of "stones," shale. Figure 4 is copied from Mr. Bruce's drawing of the out-crop of Coal; *d*, *c*, and *f*, *e*, seem to be two distinct beds running in the direction of north-east, appearing both on the island, *i*, and opposite bank; 5,000 maunds were raised from this out-crop in 1828, and a boat-load sent to Calcutta for trial; this was pronounced by Captain Forbes to be equal to English Coal, and superior to any native Coal of this country which he had seen.

62. The first beds, Figs. 2, 3, are situated at, or but a short distance above the rapids. From this to the last described bed, Fig. 4, the stream is obstructed with stones, trees, and ledges of rock, over which the water falls, as Mr. Bruce describes, with a loud noise; nevertheless, Mr. Bruce managed to get boats up to the Coal beds,



NOTES—continued.

Letter from Captain Jenkins to Captain H. B. Henderson, No. 167, 4th May 1837.

IN continuation of my letters of the 6th and 25th ultimo, I have now the honour to forward a copy of a letter of the 20th ultimo, from Mr. C. A. Bruce, regarding the Coal beds worked by him under the directions of the late D. Scott, Esq., Governor General's Agent, on the banks of the Sufry, a small stream which falls into the Disung Nuddee.

From the observations of Mr. Bruce, there appear to be several strata of Coal in this direction, and some considerably lower down the stream than where he commenced operations, and though he considered that further down to be of inferior quality to what he worked, yet I should think there was little doubt but good Coal would have been found below in the deeper strata.

Mr. Bruce alludes to having heard of Coal being found in the Dikho, and also in a river below Dhergong (Dhemsiri?), and to the very numerous position in which petroleum springs have been discovered under the Naga Hills.

My preceding letters have given information of the existence of deep beds of Coal in the Booree Dihing, and Coal was found by Captain Wilcox in two or three places in the Noa Dihing; Coal has likewise been found in Lower Assam in the streams of the Jummona, Dyong, and Kopili, so that I conceive we have every ground for supposing that a very extensive Coal formation borders the Naga Hills along the whole southern frontier of Assam, as far west as the Jynteah country.

I was in great hopes that I should have been able to avail myself of the presence of Mr. Assistant Surgeon McClelland when on his late deputation to Assam, to have some of these beds examined by him, but unfortunately the season did not admit of it, and the information I have it therefore in my power to submit is gleaned from the hurried or imperfect inspections and accounts of unscientific observers; but if the Committee are, with myself, convinced that there lies along the southern hill of this valley a series of carboniferous formations unequalled in extent by any yet discovered in India, and, as we have every reason to believe, containing some beds of Coal of excellent quality, the Committee will, I trust, consider the further examination of the tract of country in question a matter of sufficient importance to induce them to recommend the subject to the notice of Government. I do not imagine that the Coal is likely to be brought into use for the special purpose which I believe the Committee has principally in view, the supply of the Government steam vessels and boats; yet from its superior quality may be made available for other public wants, which cannot now be met except from foreign or as distant sources. But should the Coal fields of Assam be of no present service for use in Calcutta or the west of India, the full development of our abundant resources in this invaluable mineral may be the occasion of the establishment of local

Upper Assam.

beds, and to bring away several thousand maunds by this means. The river is described as very tortuous, so that the distance for which a road would be required would not be great. Hills containing clay-iron are worked for that ore, and Mr. Bruce's letter contains drawings of the method used by the natives of the place for obtaining it, which we need not copy, as this is merely by sinking wells to a depth of 10 to 40 feet into the summits of the "iron hills," and raising the ore up by means of a bamboo (for they have no rope) with a hook at the end, to which a wicker basket is attached. From the summit of the iron hills, the ore being in the form of round boulders, is rolled down the hill, and collected and worked on the spot, or conveyed in canoes to the forge. The only demand at present for iron in this quarter is the manufacture of *daws*, axes, and spears. The vicinity was, at the period referred to, a dense forest.

63. *Tyroo Ghat*.—At Tyroo Ghat, a distance probably of seven or eight miles higher up to the Suffry, Coal of superior description has also been found to occur with clay-iron stone. Specimens of both the Coal and the ore have been transmitted to the Committee: for the result of analysis of the former, see No. 62 in the Table of Analytical Results of Indian Coal. The size and circumstances of the beds in this locality are not described.

64. *West*

NOTES—continued.

manufactures, or of its conversion to use in the Eastern Provinces, and the production of results highly beneficial to the trade and commerce of Bengal. I consider it, however, quite necessary to advert to the many purposes to which our extensive deposits of Coal may be turned to productive account; but I would beg to draw the Committee's attention to the intimate connexion of our Coal beds with other minerals of the highest value, iron and salt, and the probable inducements of the known co-existence of these with Coal in the same localities, to draw European capital and skill to a province which appears only to want these stimuli to be as valuable to the state as any of the same extent.

Letter from Mr. C. A. Bruce to Captain Jenkins, 20th April 1837.

I HAVE the pleasure to acquaint you, for the information of the Coal and Iron Committee, that I was deputed by the late D. Scott, in 1828, to examine the Suffry river, where the Coal had been seen in its bed, and to extract the Coal if possible. I found a vein of Coal in the bank on which I commenced work, but as it dipped inland I was obliged to work that which was on the river, and to be able to do so I was obliged to drive stakes and to build a bank all round the vein, and to keep people constantly bailing the water out whilst digging the Coal. On the upper surface, right over the Coal, I found an immense number of trees, and amongst them many walnuts.

With about 100 men I got about 50 maunds of Coal per day, but the lower I got, and further out into the river, I found the difficulty greater in keeping the pits clear of water, for when we left off work in the evening the pits filled, and we had to throw all the water out with bamboo baskets before we commenced operations again.

I got two natives to blast the Coal, thinking by that means to get it out faster, but I suppose there must have been too much water, for we could dig the Coal out much faster with our pickaxes than they could blast it. The vein was rather a large one, I should say it was 32 cubits in breadth, all solid Coal. I might have dug six to eight cubits deep into it, and got out from 4,000 to 5,000 maunds of Coal, but am not certain, as I did not keep duplicates of my plans and work which were sent to Mr. Scott and Colonel Cooper. I, however, have three plans of the pit by me, which I had sent to Mr. Bruce, and copies of which I have the pleasure of enclosing for the Committee; from them they will at once see the nature of the work, size, &c., &c., of the pits. Over at Stoney Island I met with the same vein, but did not work there, in not being able to keep the water out on account of the stones. On the opposite side of the Suffry from our pit there was another vein, high upon the bank, but not more than two or three cubits square of it could be seen. It was set deep in stones about the size of a man's clenched hand.

Half a day's journey lower down, I saw another vein running right across the river, and a little lower down I saw two others high up in the bank. I dug a lot of it out, but it did not appear to me to be so good as the one I was working; the outside was rotten Coal, which had been worked on by the water in the Suffry, but the difficulty is in getting it down from my pit to the nearest navigable river; there lies a small range of hills on the route; the pass would have to be cut and widened to permit hackeries to get along. The river, again, is one of the most dangerous I ever met. I had to go up in the height of the rains in canoes, and suppose I was the first person that ever did so; after I had got up two or three rapids the current came down with such force, that I was obliged to send about 20 men on ahead with coir rope, to lash one end to a bamboo and float it down to the boats, make fast to one, and the people ahead would pull her up; thus each one was drawn up in succession. The noise of the water rushing over stones and past the rocks was so great that we could hardly hear one another when standing together. In going down I lost four boats, on account of the short turnings in the river and the rapidity of the current.

Could the Coal lower down be worked, there would be less difficulty, as it is not so far in the rapids;

64. *West Tyroo*.—Other beds have been observed west of Tyroo Ghat, and approaching towards the Dikhoo; but, like the last, particulars as to extent are wanting.

Upper Assam.

65. Several beds of inferior Coal are also said to be intersected by the Suffry in the lower part of its course, not far from its junction with the Disung, regarding which we have no particulars.

ABSTRACT of COAL on the Suffry.

Province.	District.	Field.	Locality.	Beds.
Upper Assam -	Suffry River -	Upper Suffry	Tyroo Ghat -	Not described.
			West Tyroo -	Not described.
		Lower Suffry -	Intersected by the stream.	a. 18 feet. b. 37 feet 6 inches. c. 36 feet. Several others not specified. 91 feet.

No. IV.—*Boorhath*.

66. The Coal beds at Boorhath occur on the Disung river, 20 miles above the confluence of the Suffry. Large boats may ascend in the rains for the Coal.

67. The first bed occurs about a mile from the village of Boorhath, at the commencement of rising ground, adjoining the channel of the stream. The bed of Coal is visible for 100 yards in length to a thickness of eight feet above the water and the gravel of the stream.

68. The second bed is about a quarter of a mile distant from the river, at an elevation of about 50 or 60 feet, and is exposed to an extent of 200 yards in length on the bank of a little watercourse.

The quality of both these Coals appeared to Major Jenkins to be very superior, an opinion which has been confirmed by analysis of specimens sent to the Committee. (See No. 72, Table of Analytical Results of Indian Coals.)

ABSTRACT

NOTES—continued.

rapids; a few rocks blasted in the cold season would make the passage much safer, and by placing large boats at the end of the rapids, canoes lightly loaded, might empty their cargoes into them, and again return the same day for another; but they should be manned with Dooks only.

I met with no less than eight different veins of Coal in going down; there may be more.

About half a day's journey from the pit, I worked there on small hills that have very good iron in them. I went and visited one; and as I happened to send a drawing of it to Mr. Bruce, and will copy and send it. The iron is smelted close to the hill, worked up into daws (knives), and sold to the Nagas for cotton, goats, spears, &c., &c. In the Suffry I met with some oil springs. I found it oozing out of the bank into the river; it was rather of a brownish colour. I also met with it not far from the Coal pit; this was of a greenish colour; samples I sent to Mr. Scott and Colonel Cooper.

My brother, many years ago, told me that Coal was seen in some river below Dergong, but the people were afraid to work it as it was so unhealthy. The Committee know of the Coal lately discovered in Naum Cheek Panney, it is said to be in the Now Dehing, but I never saw it, and if discovered it would be too far amongst the rapids to be of any use to us. I have been informed that Coal was in the Deeko river, and strongly suspect that it is.

After adverting in detail to the Boorhath and Jeypoor beds, Captain Jenkins remarks that although no other traces of Coal have yet been discovered in the immediate vicinity, it is impossible not to see from what has already been brought to light, the general uniformity of the whole tract, as belonging to the Coal formation which comprises all the small ranges of Naga Hills, for 100 miles in this direction. We may hereafter, Captain Jenkins adds, find beds extending far lower down towards the great navigable channel of the Burrampooter, and therefore offering some advantages in regard to transport. But as those advantages would be counterbalanced by greater difficulty of drainage, it seems to him that we are not likely in all Upper Assam, to find two points where Coal could, upon the whole, be worked with more advantage than Boorhath and Jeypore. The two streams, which traverse these districts respectively, the Boree Dihing and Disung, are the largest rivers on the south bank, and most fitted for navigation.

Upper Assam.

ABSTRACT OF COAL at Boorhath.

Province.	District.	Field.	Locality.	Beds.
Upper Assam -	Disung - -	Boorhath - -	1. Rising ground near the bed of the river, a mile from the river.	8 feet.
			2. A quarter of a mile from the river on an elevation of 50 or 60 feet.	6 feet.

No. V.—*Jeypore.*

69. The Coal beds at Jeypore are situated near Geeraphong, a small village, $1\frac{1}{2}$ to $2\frac{1}{2}$ miles from the old fort of Jeypore, on the east bank of the Boree Dihung river, at a distance of 40 miles from its confluence with the Burrampooter, and 100 miles above Bishenath. The beds appear to be large, numerous, and of various quality, and the Coal may be raised and delivered on the bank of the Burrampooter at $1\frac{1}{2}$ anna per maund. We find it difficult to distinguish the several beds, for want of a more discriminating account of the size and quality of each than we possess at present.

70. On the declivity of a low chain hills, two or three miles in length, extended in S.W. direction, a nine-feet bed of Coal occurs, alternating with a soft white sandstone containing "masses" of iron ore, and two smaller beds of Coal, one above and the other below the nine-feet bed.

71. A third bed, 11 feet in thickness, is mentioned as intersected by a ravine or watercourse a little beyond the nine-feet bed.

72. Somewhat better than a mile to the south of the last-mentioned bed, there are several others "trending in a direction of 350 degrees, the line of dip being 280 degrees, and dipping at an angle of 45 degrees into the hillock." Thus we might venture, perhaps, to represent these details as in the annexed figure.



73. In

NOTES—continued.

EXTRACT of a Letter from Captain *Hannay* to Captain *Jenkins*, Commissioner of Assam, 15th September 1838.

I ONLY worked the Coal to the extent of 15 yards in length and six feet in depth, and although I found a good deal of slaty substance, much impregnated with pyrites, on which pickaxes struck fire, still I did not come upon rocks, and to all appearance the vein of Coal may extend many yards further down.

The breadth of the vein, including partings, is about nine feet. Examining the beds of two watercourses which pass over the vein of Coal, I found several beds of sandstone of the description called by miners white post; it is soft and easily broken, and was intermixed with large masses of iron ore and softened sandstone. There were also two small veins of Coal, though several feet higher than the larger vein, evidently appeared to belong to the same bed, having the same dip and bearing.

In another place a quarter of a mile distant, where Captatn Hannay observed greyish coloured soft shaly sandstone, strongly impregnated with petroleum, of which it affords several springs, the surface is covered with fragments of Coal. These lead to a watercourse which intersects a bed of Coal 11 feet in thickness, which Captain Hannay supposed to be a continuation of the one he opened; proceeding down the watercourse in a southerly direction, about six furlongs distant, several beds of Coal appear, dipping into the centre of the hillocks. (See Report Committee 1841, p. 4, 5.)

EXTRACT

73. In addition to the soft red and white sandstone, the other rocks in the vicinity are described as a greenish coloured soft slaty sandstone, strongly impregnated with petroleum.

Upper Assam.

74. Regarding the quality of the Coal sent to Calcutta in 1838, from the first of these beds marked *a*, Fig. 2, 40 maunds were only equal to 32 of Burdwan. From the inferiority of the Coal itself, as well as from the nature of the shale and sandstone above described, we might venture to infer that the bed from which the sample is derived is superficial Coal, and that some of the other beds, *c*, or *h*, which do not appear to have been tried, might have afforded better results. Different beds, as may be understood from the foregoing figure, may be variously thrown up from below, so that the lower beds (*c*, *h*,) which always constitute the best Coal, may by the displacement to which Coal beds have been subjected, be as frequently found at the surface, in open day, as newer beds of which originally occupied a more superficial place.

ABSTRACT of COAL at Jeypore.

Province.	District.	Field.	Locality.	Bed.
Upper Assam -	Boree Dihing River.	Jeypore - -	Geerophong -	9 feet. Other 11 feet. Numerous other beds, particulars not specified.

No. VI.—*Namroop*.

75. Namroop Coal is situated near Beesa, 21 miles from the confluence of the Noa Dihing with the Burrampooter, 10 miles above Suddyah, thus supplying the highest navigable point of the latter river.

76. The only bed as yet observed is situated three or four miles south of the Beesa, on the bank of the Namroop river, a tributary of the Boree Dihing, about seven miles above the confluence of these streams, and $2\frac{1}{2}$ miles above the village of Namroop. The bed of Coal is 20 feet thick, forming a precipice overhanging the stream.* The quality of the Coal is of the most superior description.

ABSTRACT

NOTES—continued.

EXTRACT of a Letter from Captain *Jenkins*, Commissioner of Assam, 19th February 1838.

“CAPTAIN HANNAY was not aware of the existence of Boorhath Coal, the superior facilities of transport offered by which would otherwise have induced him to work it in preference to Jeypore Coal. But he could not so well have superintended the labourers,” &c.

* This Coal was first observed by the late Captain Bigge and Mr. Griffith, in April 1837, a fuller description of it will be found in Mr. Griffith's journal now under publication. The bank in which the Coal occurs is 30 feet high, consisting of Coal chiefly reposing on an absorbent slate clay, easily acted upon and softened by the stream. The adjacent country is composed of low hills 200 to 300 feet high, abounding in springs of petroleum and naphtha, which prevent the growth of the larger vegetation. The Boree Dihing at the confluence of the Namroop is said to be as large as the Tweed at Kelso.

The Singphos are altogether ignorant of the nature and uses of Coal, and, Captain Bigge remarked, were greatly surprised to see large lumps of it burst into a brilliant flame as soon as ignited.

Upper Assam.

ABSTRACT of COAL on the Namroop.

Province.	District.	Field.	Locality.	Bed.
Upper Assam	Beesa	Namroop	2 miles from Beesa	20 feet.

On the Carriage of Upper Assam Coal to Bengal.

77. To give the Upper Assam Coals a fair trial in the N. W parts of Bengal, advantage should be taken of such facilities as the place affords for building boats from the useless forests on the spot. The late Captain Bigge suggested a plan similar to that followed on the Damooda of building boats, and he considered that if adopted in Assam it would tend greatly to diminish the expense of carriage.

78. We may here advert to paragraph 1, Proc. Committee, 11th January 1841, by which it appears that 500-maunds boats may be built at 80 to 150 rupees each. We may also refer to another opinion, paragraph 5, Proc. Committee 6th January 1841, as to the period a boat will last, which with slight repairs is stated to be 10 years. Let us assign 10 rupees per annum for repairs, and 120 rupees for the cost of the boat.

	Rs.	a.	p.
Hence, in 10 years the boat would cost - - - -	220	-	-
For a mangy at five rupees per mensem, and seven boatmen at four rupees each per mensem, for 10 years -	3,960	-	-
Insurance at 3 per cent. on each trip, two trips per annum for 10 years - - - - -	250	12	10
Cost of 10,000 maunds of Coal at Dikhoo Mouth, on the Barrampooter, at two annas per maund, as per result already ascertained on the Boree Dihing - - - -	625	-	-
Cost of 10,000 maunds on delivery - - - - -	5,055	12	10

79. Thus, allowing a boat to make two trips a year between the line of depôts on the Ganges and Upper Assam, Coal might be delivered for a little more than eight annas per maund, each boat delivering 1,000 maunds annually; 200 boats would be requisite to meet the present expenditure.

80. Such boats might be disposed in fleets of 20 or 30, with a clashie to each fleet. A steamer might be employed, if necessary, to assist the boats and facilitate their progress.

81. The quality of Suffry Coal is already known to be most superior, that of Dikhoo is certified by the commander of the Assam steamer to be the best Coal he ever had to do with. Thus, although it might cost more, its use would be less expensive than an inferior article.

82. But the beds of Bijnee Doar, and Jumoona in Lower Assam, particularly the former, should first be looked to, as more completely within reach of Bengal.

ABSTRACT OF COAL in *Upper Assam.*

Province.	District.	Field.	Locality.	Beds.
Upper Assam.	Dunseeree River	- - -	Namber - - - - - On a line between Deoza and Chambakotee.	One not traced, Two not described.
	Dikhoo River	Namsang	Namsang Purbut - - -	{ 6 feet. 6 feet.
	Suffry River	Upper Suffry	Tyroo Ghât - - - - - West Tyroo - - - - -	Not described. Not described.
		Lower Suffry	Bed of Suffry River - - -	a, 18 feet. b, 37 feet 6 inches. c, 36 feet.
	Disung	Boorhath	Rising ground near the bed of the river, about a mile from the village. Quarter of a mile from the river, on an elevation of 50 or 60 feet.	8 feet. 6 feet?
			Geerophong - - - - -	{ 1 9 feet. 2 2 feet? 3 2 feet? 4 11 feet?
	Boree Dihing	Jeypore	One mile south of Geerophong -	Several beds, size not specified.
		Namroop	Three miles from the Noa Dihing	20 feet.
			TOTAL Thickness - - - - -	157 feet 6 inches.

KURRIBARI BROWN COAL.

Kurribari Brown Coal.

83. Kurribari is a low hilly tract situated at the great flexure of the Burramipooter, where it emerges from Assam. The hills apparently 30 to 50 feet high, consist of soft sandstone and beds of clay intersected by ravines. They are thickly wooded and overran with jungle. The face of the country continues pretty much the same for a distance of 10 miles into the interior, when the levels begin to rise more abruptly, and at a distance of 16 or 18 miles, elevations of 1,500 to 2,000 feet occur, forming the lower and outer skirts of the Garrow mountains. The Kalo river rises on the face of the Garrows, and taking a westerly course, enters the Burrampooter opposite to the village of Chilmaree. It is navigable during the rains to Putamaree, a distance of 11 miles from its mouth. Thin beds of a dull earthy Coal occur in three distinct localities on the north bank of the river.

84. Salkora, three miles inland from Putamaree on the north bank, a bed of Coal 2½ feet thick occurs, alternating with slate-clay, and friable red and white sandstone, covered with boulders and a deposit of earth. The measurements of these beds are not given, but the whole section does not embrace above 20 or 30 feet. The strata here appear to be level. The hills in which the Coal is situated are from 70 to 80 feet high.

This is of a dull brown earthy Coal, *see* No. 91 in the Table of Analysis. It burns freely with a bright flame, and might answer for steam purposes, although the expenditure would be larger than of ordinary Coal.

85. *Mirampara.*—This is situated three miles eastward of the last described. The same alternation of beds takes place here, with the exception of boulders. The beds in this situation dip 15 degrees to the west. The bed of Coal is somewhat smaller than the last, and of a more earthy nature.

Kurribari Brown
Coal.

86. *Champageree*.—This locality is intermediate between the former two, and about a mile further from Patamaree; the beds here consist of slate-clay, impure earthy coal, boulders, and clay; they dip 25 degrees to the east.

87. These beds appear to belong to one or more small isolated basins of a spurious Coal formation, and are not likely to lead to any important result. The Coal resembles specimens of the brown Coal of Bornholm, and will probably be found to be equivalent to the brown Coal formation. Mr. Sweetland submitted proposals to the Committee for working these beds on the part of Government. Doubtful, however, of their value, the Committee required beforehand to be put in possession of more satisfactory samples than they had seen. These, Mr. Sweetland undertook to supply on certain conditions, which were complied with, but failing in his object the proposal was abandoned, and should never be renewed.

ABSTRACT of *Gundoopara* Brown COAL Formation.

District.	Field.	Locality.	Bed.
Kurribari - - -	Gundoopara - -	Salkoora - - -	2½ feet.
		Mirampara - - -	2 feet.
		Champageree - - -	2 feet.

88. This brown Coal formation is not to be confounded with the indications of bituminous Coal in the same district, afforded by drifted specimens in the bed of the Bonarosee River. See para. 41, Lower Assam.

SYLHET COAL DISTRICTS.

Sylhet Coal
Districts.

89. THESE are five districts or tracts of country on the eastern frontier of Bengal Proper, in which beds of Coal have been found, together with three tracts in which the indications are so strong as to leave little doubt of its existence. These districts are all immediately adjoining Sylhet. Eleven beds of coal have already been discovered in them at various points during the last 30 years. The aggregate thickness of Coal that has been thus ascertained in the Sylhet Coal districts, amounts to 84 feet 11 inches, which is probably not half their contents.

90. With regard to Sylhet Coal generally, its quality being superior, it will on that account always have the preference for sea-going steamers. But for river navigation it would have the advantage of all other Coals for the supply of the Sunderbunds at Kulna, and Commercolly, as well as Bauleah and the lower ports of the Ganges.

91. Carriage from Sylhet to the latter station, or to Calcutta, being considered by boatmen as one and the same, the rates at which Cherra Coal may be delivered at both places would of course be alike. Hence at Bauleah it is obvious this Coal would have a decided advantage over Burdwan for the supply of the upper parts of the Ganges.

No. I.—*Doorgapore*.

92. The late Commissioner of the N. E. Frontier, Mr. Scott, was aware of the existence of Coal in the Garrow Hills. It has been stated perhaps on his authority that there are two beds in the vicinity of a village called Doorgapore, 20 or 30 miles west of Laour on the corresponding declivity of the same range; a specimen of good Coal from this quarter was presented to the Committee in 1837, but no information has since been obtained on the subject.

ABSTRACT of COAL in the *Garrow Hills at Doorgapore.*Sylhet Coal.
Districts.

District.	Field.	Localities.	Beds.
Sylhet - - -	Doorgapore - -	Garrow Hills - -	Two, conjectural.

No. II.—*Laour.*

93. Our information of the existence of Coal in Sylhet goes as far back as 1813. Inquiries at that period were chiefly directed to the hills in the neighbourhood of Laur, from the number of drifted pieces of Coal found in the stream.

94. *Patli River*.—Rolled pieces of Coal derived, Mr. Jones supposed, from several sources, are plentifully found in this river. Some of the tributaries entering into it from the mountains bring down abundant fragments, which from their appearance led Mr. Jones to conclude that some came from more distant, and others from sources near to the plains.

95. *Susung*.—A little beyond Seripore or Cheripore, and near Susung, is a small rivulet in which there is a 9-inch bed of Coal.

96. *Second Range of Mountains at Laur*.—On the top of this, the natives who accompanied Messrs. Jones and Stark in 1816, pointed out a bed of coal of good quality two feet thick.

ABSTRACT of COAL on the Hills at *Laour.*

District.	Field.	Locality.	Bed.
Sylhet - - -	Laour - - -	{ 1 Patli River - - - 2 Near Susung - - - 3 On the top of the second } range of mountains }	Not traced. 9 inches. 2 feet.

No. III.—*Disung River.*

97. In the Disung river and its tributaries, Mr. Jones found fragments of common Coal, but in less quantity than in the rivers at Laour, so much so, that 15 persons were seven days in collecting one maund without finding the source from whence any of the fragments were introduced.

98. Nevertheless, the fragments were there, an unquestionable proof of the existence of Coal. It would be erroneous to draw any conclusion from the abundance or scarcity of the fragments as to the probable extent of the beds, since large beds might exist apart from rivers or tributary streams, into which fragments could not find their way. Such is the case at Cherra Ponji, where no fragments of coal can find their way by natural causes from the mines into the adjacent rivers, which consequently contain no fragments.

ABSTRACT

NOTES.

EXTRACT of a Letter from *D. Scott, Esq.*, to *G. Swinton, Esq.*, Chief Secretary to Government of India, 14th February 1828.

"IN continuation of the subject of my letter to your address of date 1st instant, I beg to acquaint you for the information of the Right Honourable the Governor General in Council, that I understand that there are beds of Coal in an accessible situation, some miles above Doorgapore on the Sumaseree River at the Garrow village of Seejook and Rewak, from which places it seems probable that Coals for the use of the steam vessel might be supplied much cheaper on the lower part of the Burrampooter than if sent from Assam."

In the Committee's letter to Lord Auckland under date 18th October 1837, it was stated that Mr. Homfray, and Mr. Cracroft had then persons searching for this Coal, but the inquiry came to nothing. See Reports Committee, 1838, p. 5.

Sylhet Coal
Districts.ABSTRACT of COAL on the *Disung*.

District.	Field.	Locality.	Bed.
Sylhet - - -	Disung River - -	Undescribed - -	Not traced.

No. IV.—*Between Panatick and Bunsikora.*

This locality is not laid down on any map we have seen, but it is somewhere intermediate between Cherra and Laour.

Two beds of Coal are found in this locality.

99. *Barachara*.—This bed was discovered in 1816, when 250 maunds were transmitted to Calcutta for trial and approved of. The quality was found to improve still further, the deeper the bed was penetrated, which induced Mr. Stark, the gentleman to whom the discovery was due, to expect that the quality would eventually equal that of English Coal. The size of this bed is not expressly stated, but it was understood to be about six feet in thickness, and so convenient to water carriage that boats might be loaded at the mine. Mr. Stark experienced some opposition from parties in Sylhet in regard to working this Coal, which together with the success of Mr. Jones in Burdwan, caused it to be abandoned soon after its discovery.

100. Messrs. Inglis & Co., of Chattak, it is said, afterwards expended some four or five thousand rupees on this Coal, which they were obliged to abandon in consequence of its being impregnated with sulphur. This peculiarity does not seem to have been adverted to in the result of the original trials made in Calcutta by the public authorities to whom samples were submitted, nor in the trials made of it by Mr. Jones, a good authority. Admitting it to be the fact, all Coal being more or less subject to this impurity, it is not a sufficient cause for abandoning a bed some parts of which may be quite free from such objection. In the present instance, the objection rests on no definite authority.

101. *Charra Gow*.—This bed, which is seven feet six inches thick, was discovered in 1814 by Mr. Stark, and examined two years after by Mr. Jones, by whom it was abandoned in favour of the Barachara bed, para. 99, which was more convenient to water carriage.

102. The foregoing beds and indications of Coal, 93 to 101, have been neglected since 1816, when inquiries were given up in the Sylhet districts from the difficulties with which they were then beset, the hilly and mountainous tracts containing Coal being in the hands of unconquered tribes, and the demand for Coal being at the time comparatively small; circumstances are now completely altered, and a proper examination of these districts would seem to be imperatively required.

ABSTRACT of COAL between *Panatic* and *Bunsikora*.

District.	Field.	Locality.	Bed.
Sylhet - - - - -	Between Panatic and Bunsikora.	{ Charragow - - - Barachara - - -	7 feet 6 inches. 6 feet.

No. V.—*Cachar and Bikrampore.*

103. A letter from Captain Guthrie, of the Engineers, was entered on the proceedings of the Committee 2d April 1842, from which it appeared that a specimen of Coal had been found in a small watercourse on the side of a hill about 300 feet above the plain of Cachar, and half a mile distant from the Arang river, a branch of the Soorma, navigable for 600-maunds' boats four months in the year, and for dinghies for six months.

104. The

104. The following is the result of analysis of the specimens in question :—

Sylhet Coal
Districts.

Specific gravity	-	-	-	-	-	1.3
Inflammable matter	-	-	-	-	-	64.8
Carbon	-	-	-	-	-	32.2
Ash	-	-	-	-	-	2.0
						100

It is needless to remark on the interest of such a decided indication of the existence of Coal in so favourable a place for water carriage, or upon the urgency and importance of this and other similar indications of Coal in these districts being properly inquired into.

· ABSTRACT of COAL in Cachar and Bikrampore.

District.	Field.	Locality.	Bed.
Sylhet - - - -	Bikrampore - - - -	A small watercourse on the side of a hill, half a mile distant from the Arang river.	Not traced.

No. VI.—Tipperah Hills.

105. About two miles from the mouth of a small river which descends from the lower Tipperah Hills, petroleum issues from sandstone rocks near the bed of the stream. Mr. Jones sank to the depth of four feet into the rock when he found it become slaty, thus indicating, as he said, the presence of Coal. Others, he observed, can prosecute the search; the place is well known by an adjoining cluster of small sandstone hills, the most remarkable of which is called Arpeen, and has a celebrated Mussulman durga on the top.

ABSTRACT of COAL in the Tipperah Hills.

District.	Field.	Locality.	Bed.
Tipperah Hills -	Arpeen - - - -	Near the bed of a small stream, a sandstone rock from which petroleum issues.	Not traced.

No. VII.—Chaila Ponji.

106. This Coal district is situated in the Khasyah Hills, about 12 miles to the west of Cherra Ponji. It is not perhaps distinct from Cherra Ponji, but it belongs to a different native chief.

It is distinguished by three beds of Coal, which have only been made known since the attempts to work the Cherra mines were entered upon, in 1839. They were all brought to notice by the natives employed in the Cherra mines, with a view to shorten the distance to which that Coal has to be carried.

107. *Byrung Bed.*—This bed is about two miles from water carriage. It would appear to extend a distance of two or three miles along the foot of the hills, varying in size from one foot to three, and not affording more on an average than one foot of good Coal. There are, however, discrepancies in our information, regarding the value of this bed, which time and circumstances can alone remove.

Chaila Bed.—This is said to be near the Byrung bed. It varies in thickness from one foot to three, but is said to yield an inferior Coal.

108. *Mustuk Bed.*—This is situated higher on the acclivity of the mountain than either of the two previous beds. It occurs near the village of Mustuk, at

Sylhet Coal
Districts.

an elevation of 1,500 or 2,000 feet. Regarding the size and extent of the bed, there are discrepancies of opinion evincing some doubt; but the quality of the Coal is unexceptionable.

ABSTRACT of COAL at Chaila.

District.	Field.	Locality.	Bed.
Khasyah Hills - -	Chaila - - -	{ Byrung Ponji - - - Chaila - - - Mustuk - - -	1 to 3 feet. 1 to 3 feet. 4½ feet.

No. VIII.—Cherra Ponji.

109. Cherra Ponji is situated on the brow of a table-land composed of horizontal beds of sandstone, raised abruptly to a height of 3,000 or 4,000 feet from the plains of Sylhet. This table-land is capped by small groups of hills rising abruptly from it to an additional height of 200 or 300 feet, affording limestone caverns and bold picturesque scenery.

The precipices of which Coal forms a considerable part, are 30 or 40 feet high, facing the station of Cherra, from which they are not above a mile distant; they consist of coal, limestone, and shale.

110. The annexed Fig. 6 is intended to afford an idea of the general situation of these Coal beds. Above the Coal there are usually a few beds of soft sandstone, loose sharp sand, and clay. These are succeeded by thin beds of shale; the Coal varies in thickness from 2 feet 8 inches to 28 feet. The Coal rests on beds of blackish shale, passing into thin beds of sandstone, followed by a few thin beds of a dull dark coloured gritty limestone; beneath which, a compact dark bluish or blackish grey limestone containing shells occurs.



These rocks, consisting evidently of the lower beds of the Coal formation, repose on horizontal strata of sandstone already alluded to as forming the table-land.

The Coal is exposed in three particular situations at Cherra.

111. First, on the left of the road entering Cantonments, the edge of a bed 28 feet in thickness forms a considerable portion of a precipice (at 1 in the annexed Sketch). This is the nearest bed to the plains, and the one chiefly worked to supply the Coal sent down to the Presidency. It has recently been found by driving galleries into the hill that the Coal becomes thinner, and appears to wedge itself out the further it is pursued underground, so that what appears to be a 28 feet bed at its exposure in the precipice, thins down it is said to seven or eight feet.

112. About a mile from the last mentioned, another bed of Coal presents itself, two feet eight inches in thickness, at No. 2; this is also in a precipice facing Cantonments. This bed has not, we believe, been worked.

113. The third bed (3 in the annexed Sketch) is situated probably about half a mile distant from No. 2, forming an exposure of Coal about 17 feet thick on the opposite declivity.

114. These three exposures of Coal were known at Cherra since 1833. Whether any subsequent discoveries have been made we do not know; nor do we know whether these exposures all belongs to one and the same bed making its appearance in different situations, or to several beds. To determine this point would

would require more geological nicety than has yet been applied to such objects in India.

Sylhet Coal
Districts.

115. *Serrareem Bed*.—This Coal, which also belongs to the Cherra Ponji Field, is situated several miles further in the interior of the hills, at about the same elevation. It consists of a large bed of superior Coal, 12 or 15 feet in thickness, but quite inaccessible at present as regards the plains. Its application to purposes of local improvement in the manufacture of iron will be considered in the proper place.

Six or eight native forges burning charcoal are now carried on in the village of Serrareem, which stands on this bed of Coal, and there are probably 200 forges altogether in the vicinity similarly circumstanced, the manufacture of iron being the characteristic employment of the people.

ABSTRACT of COAL at the *Cherra*.

District.	Field.	Locality.	Bed.
Khasyah Hills - -	Cherra - - -	1. On the left of the road entering Cantonments, from Mosmye - -	28 feet.
		2. Facing Cantonments -	2 feet 8 inches.
		3. Opposite declivity from the last - - -	17 feet.
		Serrareem - - -	12 to 15 feet.

* GENERAL ABSTRACT of COAL in the *Sylhet* DISTRICTS.

Province.	District.	Field.	Locality.	Beds.	Average size of each Bed.	
					Feet.	Inches.
Sylhet	Garrow Hills -	Doorgapore -	Undescribed - - -	Two beds conjectural		
		Laour - -	1. Patli River - - -	Not traced.		
			2. Near Jusung - - -	9 inches - - -	0	9
			3. Top of second range of Hills	2 feet - - -	2	0
	Khasyah Hills	Disung R. -	Undescribed - - -	Not traced.		
		Between Panatick and Bunsikora	Charagow - - -	7 feet 6 inches -	7	6
			Barachara - - -	6 feet ? - - -	6	0
		Cheila - -	Byrung Ponji - - -	1 foot to 3 - - -	1	6
			Cheila - - -	1 to 3 feet - - -	1	0
			Mustuk - - -	4½ feet ? - - -	4	6
		Cherra - -	1. On the left of the road entering Cantonments - - -	28 feet - - -	28	0
			2. Facing Cantonments - -	2 feet 8 inches -	2	8
			3. Opposite declivity - -	17 feet - - -	17	0
	Tipperah Hills -	Arpeen - -	Serrareem - - -	12 to 15 feet -	13	6
			Near the bed of a small stream, a sandstone rock from which petroleum flows - - -	Not traced.		
	Cachar - -	Bikrampoor -	A small watercourse on the side of a hill, half a mile distant from the Arang N. - -	Not traced.		
TOTAL of ascertained Coal, 84 feet 11 inches - -					84	11

A R R A C A N.

Arracan.

THIS Province may be divided into three Coal Districts :

I. The Northern, consisting of indications of Coal between the southern point of Ramree and Akyab.

II. The Central districts, comprising the southern parts of Ramree and adjoining islands.

III. Sandoway, or Southern district.

117. In these districts 11 beds of Coal have been examined, affording an aggregate thickness of 15 feet 8 inches, being an average of one foot five inches for each bed, the largest not exceeding 20 inches. Where these beds are not exposed to the influence of the tides below high-water-mark on the coasts, they are so much inclined, or, in other words, placed in such a vertical position as to render it difficult to work them. In other respects, some of these beds afford superior Coal. But the best Coal yet derived from Arracan has been found in detached masses, imbedded in sand and clay, at Keang Dyeng, on the western coast of Ramree, and on the island of Muggie, as well as a small range of hills at Sandoway, thus unequivocally proving the existence in these vicinities of large beds of coal in this province.

In the northern, as well as southern divisions of the province, the rocks associated with Coal are sandstones and shales.

In the central division, limestone of dark gritty character are described as accompanying these rocks.

I.—*Northern District of Arrakan Coast.*

118. *Bolonga Islands.*—These are three islands, each about 20 miles in length, and one mile broad, placed parallel to each other, forming the southern side of the harbour at Akyab. The southern extremities of these islands seem to be composed of sandstone of the Coal formation.

On the western coast of Augne Keong, and about two or three miles from its southern extremity, Coal occurs in three adjoining, but distinct, situations, subject to the tide, the strata dipping S. W. by W. In one place the bed of Coal appeared to be five or six feet thick, in another 18 inches, a third still less.

119. At the southern extremity of the middle island, Coal occurs, also alternating with sandstone, dipping to the east. The indications afforded by the dip in these instances are interesting, as tending to establish the existence of a small submarine Coal basin at this place.

120. *Kyuk Phyu.*—At the harbour of Kyuk Phyu coal is found in three situations; namely, in the harbour itself at *a*. Fig. 7, where it is subject to the influence of the tides, and on two small islands (*b. c.*) in front of the harbour.

The submerged ridge (*d.*) between the islands and the main land is composed of sandstone, and is left dry at low water. The quality of the Coal is good, but the situation and extent of the only bed yet observed is such as to render it scarcely worth working. The annexed figure exhibits the circumstances under which this Coal occurs, as we understand them from very imperfect descriptions.



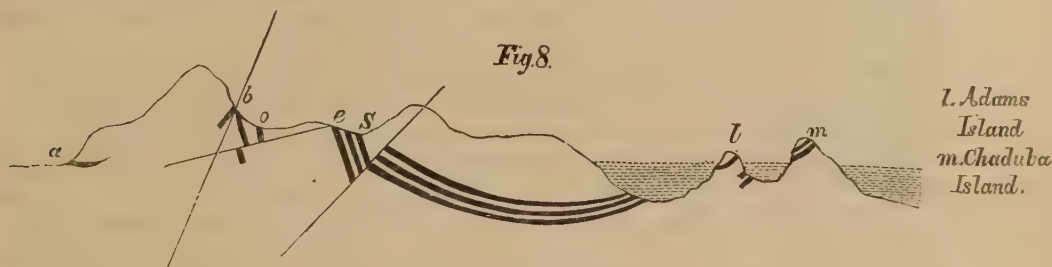
ABSTRACT of COAL at Arracan (Northern).

District.	Field.	Locality.	Beds.
Arracan - -	Bolonga Island -	Western coast of Augne Keong - - -	{ 5 feet interrupted bed. 1 foot 6 inches interrupted, very small.
		Southern front of Penec Keong.	1 foot interrupted.
		Western coast of Penec Keong.	Thin bed.
Ramree - -	Kyouk Phyu -	On two small islands in front of the harbour.	Irregular broken bed.
		On the mainland - -	Irregular broken bed.

II.—Central Districts of Arracan Coast.

121. *Hoong*.—Coal occurs at Hoong, about six miles south of the town of Ramree, close to a navigable creek falling into the Sandoway Channel. The beds of Coal that have been observed here are numerous, but the largest does not exceed 20 inches in thickness; and the strata are inclined to a very high angle, so as to render them inconvenient to work.

The following are the particulars of these beds:—Three thin beds, of 3 inches, 20 inches, and 15 inches respectively, dipping 75° to the south, at the south-western extremity of the Valley of Hoong. The third or 15-inch bed is said to be cut off by a *fault* from the two first mentioned, and to appear at a distance of 20 yards from them, causing a local irregularity of dip, as represented at *e* in the following sketch:—



122. On the northern side of the valley, skirting the range of hills in that direction, there are two small beds, at a distance of $2\frac{1}{2}$ to $3\frac{1}{2}$ miles from the first. One of these, 20 inches thick, occurs at *b*, broken by a *fault*, and dipping, it is said, 80° west, in one side of the fault, and 85° E. N. E. in the other; the second bed in this direction, *o*, is only eight inches, three quarters of a mile from which, in an easterly direction along the skirts of the hills, faults are observed with detached fragments of coal imbedded in sand and clay.

123. *Koeng Dyeng*.—On the opposite side of the Adjeekah Hills, at a spot marked *a* (fig. 8), Coal of very superior quality was found and despatched to Calcutta; but on examination of the place, a detached broken mass of Coal, and one bed only a few inches thick, were found lying near the surface, beneath projecting ledges of sandstone. We have no further observation as to the nature and peculiarities of the rocks in this vicinity.

ADJOINING ISLANDS, South of Ramree.

124. On the islands immediately adjoining the southern coast of Ramree (*l*, *m*, fig. 8), Coal has been found, chiefly in detached broken beds, which may probably be connected with the bed at Hoong, as represented in foregoing fig.

Arracan.

ABSTRACT of COAL in the Central District of Arracan.

District.	Field.	Locality.	Bed.
Ramree Island	Hoong Valley	South-western extremity	3 inches.
			20 inches.
		South-eastern extremity	15 inches.
	Koeng Dyeng	North-western side	8 inches.
		Western coast	20 inches.
			8 inches.
	Chaduba	On low hills at the south side of the island	Masses of Coal detached.
	Adam's Island	Not described	A thin seam.
	Paiget Island or Mug-gie Island	Not described	Not traced.
			Detached masses of coal-imbedded sand.

III.—Sandoway,

NOTES.

REPORT from Lieut. *Hutchinson*, dated 15 May 1842.

Arracan, from lat. $18^{\circ} 10'$ to $20^{\circ} 10'$ north (beyond which I have not had an opportunity of examining), presents one great continuous field of transition or secondary rocks, varied only by the frequent occurrence of dykes of igneous origin and points of volcanic action, either extinct or in present activity. The strata, consisting of coal-bearing sandstones, shales, and fossiliferous limestones, appear to form the true carboniferous group; but it must remain matter of conjecture of what rock the basin in which these strata were deposited consists. The highest mountains on Ramree Island, as well as those as far to the eastward of the provinces as it has been practicable to examine, consist entirely of the upheaved Coal measures, nor do the many mud volcanoes in present action throw any light upon the subject—the rejected matter consisting wholly of blue mud and the broken-up members of the same formation, with the addition only of some small broken masses of quartz rock.

Sandstones constitute the most prominent members of the formation; they are of all varieties, from very fine-grained to conglomerates; colour, yellow, grey, blue, and red, to all degrees of hardness, generally containing plates of mica, and from it obtaining a thin foliated structure.

Sandstones of a brick-red colour are only largely developed in the neighbourhood of Sandoway, where they appear to be only the equivalents to the yellower rocks of Ramree and farther northward, the clay formations and coal seams in connexion with each being precisely the same. Some of the more thickly stratified have planes of slaty cleavage, by which the rock is divided into thin plates, at an angle, generally, of about 60° with the planes of stratification. In places where the rocks are exposed to the action of the sea, a curious contorted structure, quite independent of stratification, appears, closely resembling the hard-twisted fibres of some woods, after the softer parts have been worn away by long exposure to the weather, and hardly to be accounted for as a simple ripple-mark.

Indurated clays are the next in point of magnitude, and occur interstratified with the sandstones in an endless variety of proportions, the alternating strata sometimes not exceeding an inch or two in thickness, although repeated throughout a thickness of several yards. They also vary much in induration and structure, having, in some cases, a flinty hardness, but for the most part composing a soft blue shale, with sometimes a slaty, and at others a massive conchoidal structure. The sands and clays frequently alternate with little or no admixture of the two, but more generally a sort of gradual transition is observed. Excepting a few small detached veins of calcareous spar running amongst the sandstones and shales, an argillaceous limestone (containing shells) about the neighbourhoods of “Kaendying” and Hoong is the only calcareous formation which can confidently be stated as a member of these Coal measures. There are some detached masses of highly crystalline grey or white limestone found on the southern end of Ramree Island, but it is difficult to say to what age it belongs, and no further connexion with the Coal measures can be traced than the circumstance of its resting upon their edges. In only one spot (a hill on the coast, S. E. of Ramree) have I met with anything resembling ironstone, which is a sort of flinty iron clay; but this appears to be an isolated mass, and not interstratified with the other rocks; indeed, it has more the appearance of having risen through them. The disturbing focus since the deposition of the strata have apparently been very violent, and acting, both when they were still in a soft and flexible state, contorting and, in many instances, doubling them back upon themselves again, after they had obtained a considerable degree of hardness, by which the strata are broken and thrown up at an inclination generally exceeding 40° , and not unfrequently into a vertical position. The general direction of the ridges is from N.N.W. to S.S.E. (coinciding with the great features of the country throughout this part of India). Coal seams have been found on a band following this general line of bearing from the coast below Sandoway, passing through Ramree Island to the Bolonga hills, near to “Akyab.”

“Sandoway.”—In three localities Coal is found: First, at Keitallee, in N. lat. $18^{\circ} 13'$, a seam of Coal, six inches in thickness, appears on the shore below high-water mark. The super and substrata are thin sandstones, shales, and underclay, reared up at an angle of 42° , contorted, broken, and in the utmost confusion. The seam of Coal does not extend above 40 yards in length, and is totally useless for practical purposes. It is very similar in quality to the Mergui lignite. No other

III.—*Sandoway, or Southern Districts of Arracan.*

Arracan.

125. *Kingtellie*.—About 18 miles south of Sandoway, a thin bed of Coal occurs, not above six inches in thickness. This bed appears on the shore above high-water mark. The adjoining strata, consisting of sandstone and shale, are raised at an angle of 42, contorted and broken; the seam of Coal extends about 40 yards. It is not stated in what direction the strata dip.

126. *Town*

NOTES—continued.

other Coal has been found, nor did I succeed in tracing this seam to any other spot in the neighbourhood.

Second. About a mile from the town of Sandoway, at the foot of a small range of hills, there are some seams of sandstone containing lumps of Coal, some of which weigh several pounds. After examining the hills in the neighbourhood, without discovering any indication of other coal-seams, three pits were opened on a spot where a quantity of Coal had been collected at the surface, or a foot below it, in loose detached lumps. At three feet below the surface a nearly horizontal seam of sand, nine inches thick, with imbedded lumps of Coal, was reached; then three feet of sandstone, and another similar coal-seam; 2 feet more sandstone, and then a tough blue shale, after penetrating through same depth of which the work was discontinued.

Third. Eighteen miles north from Sandoway (at "Coo") on a hill-side, a coal-seam crops out; it is about 18 inches in thickness, and, from its appearance and associated rocks, there is little doubt of its being the same which appears as one of the Hoong seams, which will be described in its proper place. Specimens of Coal were forwarded from the island of Muggea. Some lumps, I hear, weighed upwards of a maund, from which it might be hoped that a strong Coal-bed would be found here; but on examining the spot from which it was obtained, I found the seam of sand, with imbedded lumps of Coal, as at Sandoway. Similar seams appear at the southern point of Ramree Island, and again at the northern extremity, passing through the Cap and Saddle Islands. I also found a seam much resembling it in the Adjeekah hills: a thin seam of Coal crops out amongst some low hills on the south side of Cheduba, which I have no hesitation in identifying as one of the seams appearing at Hoong.

A large quantity of Coal had been sent as a specimen from "Kaendying." It was obtained on the eastern side of a small detached range of hills, at a spot about 50 feet above the plain at their foot. The face of the sandstone rock had fallen in upon the excavation from which the Coal had been worked, and it was not until a large quantity of rubbish had been removed that a seam, a few inches thick, of broken coal mixed with clay, was uncovered. The seam is covered by a coarse soft sandstone, which slips down in large irregular-shaped fragments, and has much the appearance of having been in some way shaken throughout. It contains frequent crystals of iron pyrites.

The native authority, who superintended the collection of the Coal, declares that it was found accumulated on this spot in the same detached lumps, nearly the whole of which he sent into Ramree. A spring of water and other circumstances show plainly the existence of a fault passing through the spot, and I can only account for the appearance of the Coal by supposing it to be part of a seam broken up and thrown into its present place by a rupture and movement of the containing rocks; no regular seam has been discovered in the neighbourhood.

"The Bolongas:" minute seams of Coal appear upon "Peney Kyoung" and the small island at its southern extremity.

Upon "Augrey Kyoung," a seam, about 18 inches in thickness, is exposed at the southern extremity of the island; in this seam the shapes of the trees are in a great measure retained. The Coal breaks up in slabs across the fibre of the wood, the trees parting from each other so as to show their original shape and girth, the seam dips towards the sea (S.W.) at an angle of 55°, and is below high-water mark. Its enclosing rocks coincide in a great measure with those connected with the Coal at Kingtellie. Were this even a thicker seam, it would be useless for practical purposes, from the peculiarity of its position and dip. No other seams have been found on this island.

"Hoong:" the edges of the upheaved strata here assume a general direction at right angles to the usual N.N.W. line, the hill-ranges running in nearly an east and west direction. The plains of Hoong are bounded on the north by one of these ranges, extending eastward from the foot of the Adjeekah hills, through a distance of six miles to the seashore; on the south are interrupted ranges running nearly parallel to, and at a distance of a mile or mile and a half from, the former for two miles, after which they diverge towards the south-east. The upper end of the valley is closed by ranges running nearly north and south.

Three distinct seams of Coal appear at the western or upper extremity, one of which is a dirty seam three or four inches in thickness. The second is a regular clean coal-seam 20 inches in thickness. These two lie conformably, with 80 feet of coarse sandstone between them. They dip 75° southward, and can be traced some hundred feet through the hill to the westward. It was from the thicker of these seams that a large specimen was sent to Calcutta under the denomination of "Hoong Coal." They are cut off on the east by a fault running N.N.W. and S.S.E., on the opposite side of which, and 40 feet northward on the line of dislocation, a third seam crops up to the day. This seam is 16 inches in thickness, and dips unconformably to the other seams, 60° towards E.S.E. Its enclosing rocks are also different, being thin-bedded sandstones and slate clays; one mile further eastward we find a thin seam of foul coal, and a quarter of a mile further a seam eight inches in thickness; and advancing another half-mile we have more foul coal, from which spot following the northern range we have minute veins and other indications of Coal nearly to the seaside. Returning to the point first started from, and following the hill on the other side of the valley, we have at a distance of 1½ miles underclay, containing minute bits of Coal; one mile further there is a seam of Coal cut by a fault, and dipping in two different directions, the one being 80° west and the other 85° E.N.E.; the seam on one side is 20, and that on the other eight inches in thickness; the rocks resemble those of the third seam at the upper end of the valley. Three quarters of a mile further eastward a collection of underclay, containing detached pieces of

Coal,

Arracan.

126. *Town of Sandoway*.—In a small range of hills, about a mile from the town of Sandoway, detached pieces of Coal occur imbedded in sandstone. Three feet below the surface a bed of sand occurs, nine inches thick, with numerous fragments of Coal. Three feet of sandstone follows, and beneath this a similar bed of sandstone with fragments of Coal again occurs. This is succeeded with blue shale, which has not been penetrated.

127. *Coo Hill*.—About 18 miles north of Sandoway, on the same coast, a bed of Coal 18 inches thick occurs on the side of a hill; and on a small island opposite this situation, called Muggie, detached masses of Coal occur imbedded in sand, the same as at Sandoway.

No observations have been made as to the dip of adjacent strata, so as to enable us to afford a diagram of the indications of Coal in the Sandoway district.

ABSTRACT of COAL at Sandoway.

District.	Field.	Locality.	Bed.
Sandoway -	Kingtellie - - -	On the beach - - -	6 inches.
	Town of Sandoway -	{ Sandstone hills in the vicinity. }	Not traced.
	Coo Hill - - -	18 miles north of Sandoway	18 inches.
	Muggie Island - -	- - - - -	Not traced.

NOTES—continued.

Coal, occurred. It proved to be six feet in length, three in breadth by $2\frac{1}{2}$ in depth, being in the upper part of a fault passing through yellow sandstone, the rest of which appeared to be filled up with a blue mixture of sand and clay. The frequent occurrence of thin coal-seams on either side of the valley would point out this spot as the field for any further experiments which might be determined upon. None of the seams at present known are of sufficient thickness to be turned to practical use. The great complexity of the dislocations amongst the hills render it impracticable to ascertain the relative connexion of the seams to each other, or to obtain anything like a probable section through the measures by a mere surface survey; although the great dip of all the rocks would appear to offer great facilities for doing so, the plains being covered with a deep soil with but few deep watercourses. Sections can only be obtained by ascending the hill torrents, and here the examination is subject to constant interruption, and complicated by a repetition of strata so exactly alike, that I am unable to furnish anything like a complete section of the measures. I suppose that the coal-bearing strata which appear about Hoong occupy a total thickness of about 1,000 feet; the rocks composing the hills on either side certainly exceed 3,000 feet in thickness. It is probable that the rocks towards the centre of the valley are more regular, and it is possible that they may contain thick beds of Coal; but it appears probable that if such beds do exist, they are either at an impracticable depth, or that they would have appeared cropping out amongst the hills. A set of borings would ascertain this point, but as means must be provided for putting down the rods to a depth of at least 500 to 600 feet, I should not feel justified, under all circumstances, in recommending an experiment of the sort being made. It has been my chief aim to examine the whole of the coal-seams which a surface survey might bring to light, and be able to report upon them by the close of the fine season. Finding the seams which appear at the surface of no use for mining operations, I have moved over the ground as rapidly as possible, paying but little attention to matters not immediately aiding in forming a right estimate of what practical advantages might arise from pitting or boring experiments, nor do I here remark upon the few other subjects of scientific interest which have fallen under observation.

The southern end of Ramree Island in particular has been minutely examined, with a view to ascertaining the whole thickness and contents of the strata, and the relative position of the already known Coal-beds. The chart will show the confused state of the strata, and (remembering that the hills are covered with an all but impenetrable jungle) the difficulties under which such an inquiry must be made. The dip of the strata being about 50° from the coast, through the Adjeeka hills, for a distance of three miles, gives a thickness of 3,500 yards of alternating sandstones and shales, in which no useful coal-seams are found; other sections are shown upon the charts; the high dip of all of which, with the general disturbance of the strata, renders it more than probable that did any useful seams of Coal exist, they would have been found, as in addition to my own survey the native population have been searching the country in all directions. The occurrence of some of the same coal-seams, both on Ramree and in the direction of Sandoway, with the general dip of the strata inwards, gives the idea of a trough, the strata of which pass under the sea to rise on the other side; and in this case we have still less reason to expect the existence of hidden coal-seams, as the edges would have been all under examination, excepting only such as lie below the sea. There are one or two localities, on small islands, &c., where small quantities of Coal have been found, which I have not actually visited; but they all lie within the general N.N.W. belt, and I have doubtless seen the same seams at other places.

TENASSERIM PROVINCES.

Tenasserim
Provinces.

128. Four Coal fields are indicated in these provinces :—

- I. On the Great Tenasserim River, 67 miles above Tenasserim Town.
- II. Above the Falls of the Great Tenasserim.
- III. On the Thian Khan or great branch of the Little Tenasserim River.
- IV. On the Lenhea River.

The first of these are mere indications ; the second consist of a six-feet bed of crop Coal, which has already been worked to some extent, but abandoned as of inferior quality.

The third or Thian Khan Coal field is decidedly the most important, both from extent and situation, as well as the superior quality of the Coal. It was at first supposed to be situated beyond the boundary range of hills, but such is not the case ; so that there is really nothing to prevent this from becoming the most important Coal in India, particularly for the supply of Ceylon and the Straits.

Of the fourth Tenasserim Coal field, we as yet know nothing more than its existence on the banks of the Lenhea River.

I.—Great

NOTES.

REPORT on the Coal of the Great Tenasserim, by Captain *Tremenheere*, Executive Engineer, dated 10 June 1841.

THIS Coal field is situated on the Great Tenasserim River, about 67 miles from the port of Mergui. The delta of the river occupies 20 miles of coast, within which space there are many outlets, but the navigable channel discharges itself three miles south of the town. Its course in ascending has a south-eastern direction for 38 miles, when it turns suddenly to the northward ; it is here joined by the Little Tenasserim River from the south ; and the ancient capital of the province, the town of Tenasserim, is situated at the point of junction. The Coal is 17 miles due north of Tenasserim, but the sinuosities of the river increase the distance to 29 miles.

Locality.

2. The banks of the river are, in a few places, 100 and 120 yards apart ; but 200 yards may be called the average breadth above Tenasserim : below this, it is in no part less than 300.

The River.

It discharges a large body of water during the south-west monsoon ; the greatest difference of level at different seasons observed at the Coal site is 35 feet ; and though there is a rise of tide at Mergui of 18 feet, ships at anchor there during the freshes are said not to swing to the flood. At Tenasserim the daily rise and fall is 6 feet, which, 16 miles higher up, is reduced to $1\frac{1}{2}$ feet ; and though the highest springs are felt within eight miles of the Coal, the tide cannot be said to assist navigation for more than 54 miles.

3. I passed up the river, for the purpose of inspecting the coal-mine, between the 12th and 16th of April, when the channel is confined to nearly its narrowest limits. For the first 49 miles, it is little affected in point of utility by the changes of season ; it affords for that distance a broad and deep channel, entirely free from rocks or other impediments, and is at all times fit for inland navigation of any description. Above this, the course becomes more tortuous, and the rise of its bed increases by a succession of platforms, the edges of which present, at this season, sloping ridges of gravel across the stream which cannot be avoided.

Obstructions in the river.

They are 14 in number, but the difference of level at each step is not great, and the current not accelerated thereby at any one point to more than $4\frac{1}{2}$ miles per hour. The depth of water above and below was usually three feet, but on these gravel banks it varied from 1 foot 10 inches to 1 foot 6 inches and 13 inches. They are from 40 to 80 yards in extent, and form with the sand-banks some sudden turns in the stream. Its width for the last 18 miles was very variable, but there is, one point excepted, abundance of waterway, and no other obstructions than the banks just described. At the point alluded to, the stream was restricted to 70 feet, with a current of $3\frac{1}{2}$ knots, the current at other parts being about two knots.

4. The time occupied in proceeding from Mergui, in a boat drawing two feet of water, was four days. Delays occurred at each of the shoals, but not of long duration ; the gravel was easily moved with the aid of the current, and the boat dragged over it.

Time of passage from Mergui.

5. It has been mentioned that the general course of the river above Tenasserim is from north to south, which is likewise the case at the locality of the coal. It here passes through a valley four miles long in this direction, and two miles across in its broadest part from east to west. On the east, it is bounded by a high range of hills, to which the river is nearly parallel, and on the west by a minor range, which touches the river at its northern and southern extremities, and turns away from it one mile in the centre. There is a gorge at the central part of this minor range, giving rise

Physical features of the Coal basin.

Tenasserim
Provinces.

I.—*Great Tenasserim River.*

129. Coal occurs on the banks of the Great Tenasserim River, at a distance of 67 miles from Mergui. The river, at the place where the Coal occurs, enters a valley about eight miles in length and two in breadth. The valley is formed by mountain ridges, the highest of which, on the west side of the river, seems to be about 800 feet; but on the east bank they attain twice that altitude, at a distance of three or four miles from the river. The valley consists of Coal formation, such as thin beds of shale, containing impressions of plants, alternating with thin beds of coarse sandstone and Coal, partially subdivided by low hills, composed of clay, slate, and porphyry, along the flanks of which an outcrop of Coal is observed.

130. The

NOTES—continued.

rise to a stream which has been hitherto known as the Coal Nullah, as the Coal was first pointed out by the late Dr. Helfer in the bank of that stream, at the point marked I in the plan, from which spot the Coal exported recently from Mergui has been obtained.

The bed of Coal.

6. The bed of Coal, which has been worked under the superintendence of Second Lieutenant Hutchinson, is six feet in thickness, and crops out to the day in the left bank of the stream, its upper surface being on a level with the water in the dry season, and covered by a few feet of shale with the soil above. It dips to the east, or towards the river, at an angle varying from 24 to 29 degrees. There are several smaller seams below this, alternating with clay to the depth of 18 feet, but the upper one of six feet is the only workable bed.

The mine.

7. The mine was opened from the outcrop of the Coal, and carried down the angle of dip: the chief working has been to the left, or north of the first excavation, as the dip on that side is less by five degrees. Being situated in the bed of the stream, and covered only by porous material, it was much impeded by water during the rains; and though the course of the stream was turned, the pumps in use, of five-inch diameter and one-foot lift, were insufficient for unwatering the mine at each fall of rain and rise of the water-level in its immediate vicinity. The pumps were worked by hand labour. In December last, a marine engine of 10-horsepower was received for this purpose, which was put together on the spot, and enabled the work to proceed. The pumps were then connected with the engine, making 40 revolutions per minute, a speed which, owing to the smallness of the diameter and lift, it was necessary to maintain, but which is totally unadapted to mining operations. No pipes were received with the pumps, but hollow bamboos were substituted; and the means supplied were, in my opinion, quite inadequate for working a mine of any extent, or to the expectation, except under the most favourable circumstances, of a profitable return for money expended. The angle of dip at which the work has been carried on is one of great practical inconvenience, and I have much doubt whether, even with complete machinery, Coal could have been obtained from this mine, excepting for a very short period, so as to be shipped at Mergui, at a rate at all approaching to the average price of Coal in India. Much, however, has been done by the exertions of Lieutenant Hutchinson; about 1,000 tons of Coal have been got out during the 20 months since ground was broken, and the skill and ingenuity shown in the management of the very imperfect means placed at his disposal are highly creditable to that officer.

8. The operations should not, in my opinion, be considered as those of a coal-mine, but as an experimental working; and when the large sums of money expended at the commencement of undertakings of this nature in other countries, before Coal is reached, are also considered, I shall, I trust, be able to make it appear that the prospects from this Coal field are not discouraging.

The Coal formation.

9. Nothing satisfactory appears in the nature of this Coal deposit to enable me to refer it to the true Coal measures of the carboniferous system. There is no trace of limestone of any description, or of red sandstone, either old or new, within the distance of several miles, to which observations of the structure of the country have been made. The surface of the hills on either side of the basin, and for a considerable space towards the centre, is covered by an overlying claystone porphyry, which bears no relation to a deposit of Coal. This is thickly penetrated by veins of quartz, and the hills on the west (judging by the large masses of quartz with which the ravine abounds) consist principally of that rock; while the streams on the east, containing tin and fragments of slate, denote the primitive structures of the mountains on that side of the river. The only other rock in the neighbourhood is a ferruginous gritstone dipping immediately below the Coal-beds, but I saw in it no character to allow of its being placed so low as the carboniferous system.

The shales from the roof of the Coal have numerous vegetable impressions, but of small size, and they appear to be allied to existing species. The series of beds above the Coal which are seen in the opposite side of the river, and will be hereafter described, amounting to 500 feet, consist chiefly of soft shales of various colours, sandstone, and shale conglomerate, composed of the debris of other strata similar to their own. They are also intersected in two places by parallel dykes of igneous rock, but none of them seem to have undergone that degree of pressure and solidification which is apparent in coal-measure shales of the older periods, nor have there been yet seen any specimen of organic substances amongst them to authorise their being referred thereto.

10. In the absence of guides by which these questions are usually decided, and with the anomalous character of the adjoining rocks, the true nature of the Coal must be determined by external characters, by its behaviour in the fire, and by its composition.

The quality of Coal.

11. It is found in a hard and solid bed, consisting of layers of slaty structure, parallel to the bed, and is easily separated in that direction. Between the lamin there are thin plates of arsenical iron pyrites.

It

130. The rocks dip at various angles, from 30° to 9° , towards the east and south. On the east side of the basin no observations on the dip of the strata appear to have been made. The annexed diagram shows the circumstances of this Coal: a six-foot bed is covered by merely a few feet of shale, a bed of clay, and a



recent deposit, coarse grit or sandstone alternating with shale; and three thin seams of Coal occur beneath the six-foot bed to a depth of 18 feet, which is the lowest depth to which the ground has been well explored. Such being the limited extent of our information, no opinion can be formed as to the probable existence of other large beds of workable Coal in this basin. There cannot, however, be a doubt as to its belonging to the true Coal formation, from the nature of the Coal itself,

NOTES—continued.

It is brought to the surface in cuboidal pieces, which do not, however, preserve their size under rough treatment. Its cross-fracture is conchoidal, and it is fibrous, dividing into thin plates in the opposite direction, while its flat surfaces present a ringed appearance, much resembling the ringing of wood, as seen in transverse sections. Its lustre is somewhat glistening when freshly broken on the mine, and colour dull black; but after exposure to the atmosphere it loses this appearance, and assumes a brownish black colour. It does not soil the fingers, but is deficient in that "glow" or metallic lustre which is eminently characteristic of mineral Coal. Its specific gravity is 1.2. In the flame of a spirit-lamp it exhibits some inflammable gas, and gives off a small quantity of brown oily bitumen; it does not swell, and emits but little smoke. It consists chiefly of carbon, and leaves, when well burnt, a very small portion of residue.

100 Grains of this Coal gives,—		Grains.
Of Volatile matter	- - - - -	95.80
„ Soluble matter	- - - - -	.98
„ Insoluble matter	- - - - -	1.56
„ Earthy residue	- - - - -	1.66
		100.00

In an open fire it refuses to enflame without the action of the bellows, and will not do so without a strong draught. When burnt in the fire, its appearance very much resembles that of common charcoal, the thin plates before mentioned assuming that divergent shape observable in charred wood. The conclusion to which, from the foregoing considerations, I have arrived is, that it belongs to that description of Coal termed Wood Coal or lignite.

12. Its serviceable qualities are not best determined in the laboratory. It burns well in the fires of the marine engine at the mine, and no difficulty is found there in keeping up the steam. The fire-bars were placed at small intervals to suit the Coal, which is liable to break up into small pieces. No rate of expenditure had been determined, as the engine was worked much under its full power: 20 tons were shipped at Madras in the "India" Steamer, and the report by the commander, Captain Henderson, and of the chief engineer on board, which was published, is satisfactory. It is stated to require great care and labour "to manage the fires well, but not more than is required with the Burdwan Coal; that it has a strong heat, and could keep good steam with careful firing." Its consumption, when compared to English bituminous Coal, was estimated as 4 to 3, during a short trial, and from 10 to 12 maunds per hour. I have heard, however, other statements, which are not so favourable. I find that a ton weight of the loose coal occupies 165 cubic feet. There are at present about 100 tons at Mergui, and I would suggest that a careful trial be made of this quantity, to ascertain its real effect in the duty of steam-engines.

13. I proceeded to trace the connexion of the bed with the adjoining rocks, and to ascertain, if possible, the position of the Coal-beds of this locality. The ground had been penetrated in four other places besides the mine (marked 2, 3, 4; 5 in the plan), all in its immediate neighbourhood. No. 2 shaft passed through the six-foot bed at the same level as in the mine, and it was found to dip at the same angle; below this, smaller seams, not exceeding one foot, alternated with seams of underclay for 18 feet; 20 feet of a quartzose rock and conglomerate were penetrated afterwards, and the shaft then discontinued for want of means to get the water out. The object of this sinking was to find deeper Coal. A detached fragment of Coal containing some bitumen was found. No. 3 shaft was driven through 40 feet of shale, with vegetable impressions covered only by the soil, and abandoned. No. 4 shaft was sunk with reference to future work: after going through the clays and sands at the surface, and 61 feet of conglomerate, dipping in like manner with the Coal, it stopped

The strata penetrated

Tenasserim
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itself, as well as of the beds with which it is associated. It would seem, however, from all we can learn, as well as from samples of the Coal, to belong to the upper portion of the Coal formation; and it may be a question, as suggested by Captain Tremenneere, whether in a space so circumscribed, and cut off by primitive mountains, the lower and better beds of Coal are to be expected in this valley.

131. The

NOTES—continued.

at 95 feet, till means should be available for carrying it deeper, it being the intention to move the engine here at the commencement of the monsoon, when the old work would be no longer tenable; and if the dip of the Coal continued the same, it was expected to be reached at 300 feet. Boring No. 5 was carried 40 feet lower than this shaft, but without showing any indications which could be relied upon.

The site of the work-
ing.

14. It will be seen on the plan that the site of these shafts is on the immediate vicinity of the central part of the minor range of hills on the west bank of the river before noticed; their steep slopes extend within 250 yards of Nos. 1, 2, and 3, which are either upon or close to the upturned edge of the bed of Coal. As this, as well as all the accompanying strata penetrated, rested at the inconvenient angle of not less than 24 degrees, my first objects were to ascertain the extent of the Coal field, and whether the same or other beds might not be found in a position more convenient for practical purposes.

The Coal beds on the
east side of the river.

15. The configuration of the ground, an elongated trough or basin between two ranges of hills, gave me reason to believe that these were the natural limits of the Coal beds which had been exposed to view; and having, on my passage up the river, observed shale and sandstone with vegetable impressions in the left or east bank, about a mile below the coal-wharf at V, I examined, at an early period of my visit, the rocks on that side. I found here the whole series of Coal beds, consisting of sandstone shales and Coal interstratified, and lying with great regularity and low angle of dip between *o* and *c* for three quarters of a mile on the line A B in the plan. They are inclined down the stream, or towards the S.E. on the direction of the bank, and rest upon each other for the space mentioned, at an angle of from 9 to 7 degrees. Tracing the beds from point V. in the plan, two faults are found at *s* and *o*, between which points the strata are thrown down in the same direction, and to the east at an angle of 30°, but on the north side of the fault, *o*, they are undisturbed, and dip at an angle of 7°. At *n* a small seam of Coal appears; at *e* the shale is of blue colour, with numerous vegetable impressions and Coal, and at *d* there is a seam of Coal cropping out at the level of the river. The intermediate shales are variegated, brown, white, striped blue, and black.

Thickness of these beds.

16. Section No. 1 represents these beds as they appear at different points above the level of the river along the line of bank A B. The measurements taken on the line and the uniform angle of dip gives a total thickness of 500 feet.

17. At the point *c* there is a change in the rocks, and hardened red clay with rounded fragments of shale passes into the shales, but without any alteration on the angle of dip; and at 200 yards up the stream they cease altogether, the bank being then composed entirely of clay.

18. In proceeding higher up the river with a view to trace these beds and ascertain their true angle of dip, and after passing the hill at E, the northern extremity of the lesser range, there is a reach of the river bearing east and west, or nearly at right angles to its general course; and at the western part of this reach I again found the same series of Coal beds well exposed on the bank for half a mile along the line C D, as shown in section No. 2. They have evidently been the cause of this short and sudden bend of the river. The rocks first appear in this reach near the point D, where for a short distance, as at *b, c*, on the other face, they are hardened by contact with a dyke of igneous rock, which shows itself at C' in the line C D. At *p*, soft shales with seams of underclay and Coal are found; at *d'* a seam of Coal crops out at the level of the river, which being at the same level belongs without doubt to the same beds which are indicated on the other side of this tongue of land at *d*. The beds upwards from *d'* consist of striped blue and soft grey shales, the whole resting uniformly upon each other and dipping at one angle of 12° up the stream, or to the eastward till we arrived at the point *o*, where there is another igneous dyke, and the strata are thrown down thereby to the eastward, at an angle of 30°. These were followed as far as the point S' in the Yaibou River, to which they continue at the same high angle, but beyond this and for some distance higher up the Yaibou all trace of them is lost.

19. The correspondence of the bed *c' c*, *d' d*, of the dykes *c' c*, *o' o* and faults S' S and the phenomena accompanying them leads at once to the inference that the edges of rock, as seen along the lines C, D, A, B, present two views of the same beds, that their angle of greatest dip is 12°, and that they are continuous from one side of this tongue of land to the other. In examining the country inland, the dyke *o* was distinctly marked at various points between *o* and *o'*, and its direction is shown on the plan.

Igneous rock was also found at intervals between *c* and *c'*, denoting that though these igneous dykes passed through the Coal field, and disturbed the continuity of the beds, they remained between the two dykes and across the tract between *o' c'* *c o* unbroken, and resting on one another with great regularity, at an angle with the horizon varying from 7, 9 to 12 degrees. The space covered thereby is 1½ miles in length by 400 yards in average breadth.

The workable bed of
Coal.

20. The bed of Coal at *d' d* I believe to be of the same thickness and quality as that which has been worked at the mine. There is in the bed of the stream, near the opening of the mine at I, the fractured edge of a ferruginous rock distinctly marked, which dips immediately below the Coal at the same angle with it, and has been forced up at the same period. The bearing of this edge is 2½ degrees east of north, which is denoted by a black dotted line in the plan. The position of the outcrop of Coal *d'*, which was arrived at by observations independent of the line of bearing alluded to

131. The six-feet bed though a surface Coal, was worked to some extent, but the result was not altogether satisfactory. The means employed are supposed to have been inadequate to afford a fair trial. But as the objection lay to the quality of the Coal, it may be doubted whether any means that could be brought to bear could improve it, otherwise than by the discovery of a better bed.

ABSTRACT of COAL on the Tenasserim River below the Falls.

District.	Field.	Locality.	Beds.
Great Tenasserim -	60 miles above Tenasserim Town.	In a small valley, quarter of a mile from the west bank.	6 feet.

The

NOTES—continued.

to, is as nearly as possible upon this line, and the Coal shown at these two points formed, I conceive, at one period a continuous bed. A quantity of hard specimens were collected at the points *d d'* as soon as the Coal was pointed out, but being on a level with and below the water, with a high precipitous bank above, the depth of the bed could not be ascertained immediately.

Instructions have been left with Lieutenant Hutchinson to penetrate the Coal near the two points *d' d*, and report on the thickness of the working bed without delay.

Section No 3, which is taken in a direction from west to east, from the gorge of the lesser range at G. to the east bank of the river at *m*, shows the relative positions of the Coal which has been worked and the bed *d d'* at the point *m*, where the section strikes the opposite bank. It includes the shafts and other excavations, the depths of which are shown at their proper level. The space between these and the river is covered by sands, clays, and other superficial deposits without any indication of Coal.

The beds are broken off abruptly along the line A. B., and the depth at which they might be found on the west side of the river, in the absence of any other indication than the disturbed strata at 1, 2, 3, 4, would be subject to much uncertainty. The space to the northward of this between the line G. W. H. and the outcrop of Coal at *d* and the points *d L* would be subject to the same chances; but supposing the bed to be continuous with regularity across the river to the south, it would not be reached at any intermediate point between L and M along this line at a less depth than 330 feet below the lowest level of the river.

21. For these reasons I am compelled to recommend that the work hitherto prosecuted on the west bank shall be entirely abandoned, and if it be desirable to raise Coal from this Coal field, that the operations may be transferred to the other side of the river, within the limits of the space marked by a dark shade on the plan, and bounded by the igneous dykes before mentioned. The Coal measures within this space lie in a manner unusually favourable for mining, as, independent of their moderate angle of dip, they are protected from all but surface waters by the high inclination of the strata on the outer side of the igneous dyke *o' o*, which dips away from them to the east at an angle of 30°, and the Coal may be reached within the limits of the space *o d* and *d' o'*, in the plan at such depth as may be selected with reference to the extent of work intended. (*Vide* section, Nos. 1 and 2.) The total depth of these beds ascertained is 500 feet. There is every reasonable probability of their continuing the 6 feet seam of Coal (one most-convenient size for working) as indicated at *d* and *d'*, and within this mass of Coal bearing strata there may be other beds of workable Coal. Experiments below the lowest beds here seen would not, I think, be attended with success.

Recommends the mine, &c. to be abandoned, and work to be continued on the opposite side of the river.

22. The superficial area covered by the portion of the bed of Coal on this side of the river considered workable, I estimate at 280 acres. Its dip varies from 12° to the N. E. by N. at the northern extremity *c D*, to 9° and 7° to the S. E. by S. at its southern edge A. B. It crops out at the surface at the two points *d d'*, and to the eastward of a line joining these points for the distance of 440 yards—it may be reached at any depth not exceeding 50 fathoms from the river level. Experimental shafts are in progress near the points *d d'*; but pits for work should be placed first along the line *e' g'* parallel to *d d'*, and distant 160 yards where the Coal will be found at 100 feet below the same level, provided the field is not otherwise broken up by faults and dykes than by the two longitudinal igneous dykes represented in the plan. No indication of such further disturbance has been yet observed; but to provide for the contingency I should recommend that the line for pit work should be kept as above suggested within a moderate distance to the eastward of the line of outcrop of Coal. The ground near this line is low and favourable for work, and Coal may be raised at either end of the bed at 500 yards from the river and lowered from the bank over deep water.

The extent of workable Coal.

23. It would lead, however, only to disappointment, if work be commenced on this side of the river without some important additions to the machinery at present available. The engine itself is of old construction and requires frequent repair, but for power it is effective when in order. Its speed, 40 revolutions per minute, is not adapted for mining purposes, which must be reduced to 15 per minute by additional wheel work to make it available as a pumping engine. The rest of the machinery on the spot consists of 1 forcing pump, 5 in. diameter and 10-inch lift without air vessel, 3 suction pipes, 5 in. diameter and 1 foot lift without pipes; 72 feet of 3-inch pipe, and 2 iron winches worked by hand. These, excepting the winches, are too small for use, and pumps, of proper dimensions are indispensably necessary, and should be supplied before it is attempted to raise Coal. A memorandum of the machinery and stores required for immediate use, together with drawings of gear, &c. by Lieutenant Hutchinson, is submitted herewith, enclosure No. 1. It involves the smallest outlay, which will enable the work to proceed with advantage.

Additional machinery required.

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Provinces.

The fault for which this coal was condemned, and the mine abandoned, was, that it contained pyrites, and was on that account subject to spontaneous combustion;

NOTES—continued.

24. The following is an account of the expenses of the present establishment, and of that which would be required after the requisite additions to the machinery have been made:—

For One Month.

Present Establishment.	Amount.	Number required when Machinery is complete.	Amount.
	<i>Rs. a. p.</i>		<i>Rs. a. p.</i>
Superintendent - - -	200 - -	- - - - -	200 - -
Sub-Assistant Surgeon - -	185 - -	- - - - -	185 - -
1 Overseer - - -	50 - -	- - - - -	50 - -
4 Miners at 30 rupees each	120 - -	- - - - -	120 - -
3 Smiths " " - -	90 - -	4 Smiths at 30 rupees	120 - -
1 ditto at 40 rupees - -	40 - -	- - - - -	40 - -
1 Carpenter at 45 - -	45 - -	- - - - -	45 - -
3 ditto at 35 - - -	105 - -	- - - - -	105 - -
4 ditto at 30 - - -	120 - -	} Not required after the machinery is erected.	
1 ditto at 20 - - -	20 - -		
1 Head Cooley at 13 - -	13 - -		13 - -
6 Coolies, about the mine and workshop, at 12.	72 - -	- - - - -	72 - -
4 Coolies cutting trees for mine at 10.	40 - -	- - - - -	40 - -
1 " felling timber at 10.	10 - -	- - - - -	10 - -
10 " building and repairing at 10.	100 - -	- - - - -	100 - -
16 " carrying rice and other stores from the river side.	160 - -	Not required after a tram-road is placed.	
TOTAL - - - Rs.	1,370 - -	TOTAL - - - Rs.	1,100 - -
Convict Labour.		Convict Labour.	
21 Convicts about the gaol, hospital, and in charge of tools.	- -	21.	
1 Carpenter - - -	- -	1.	
8 Sawyers - - -	- -	8.	
32 Colliers - - -	- -	30.	
53 Passing away and heaving coal.	- -	15.	
10 Lower pumps - - -	- -	Not required.	
21 Road making - - -	- -	20.	
2 Oil Mill - - -	- -	2.	
7 paddy cleaning - - -	- -	7.	
9 Cooks - - -	- -	6.	
31 Sick and convalescent, at 16 per cent.	- -	11 at 10 per cent. for lighter work.	
195 Convicts at 5 rupees -	975 - -	121 Convicts at 5 rupees each	605 - -
Boat hire, and other small expenses.	150 - -	- - - - -	150 - -
		Supervisor of Bamboo Forests	20 - -
		1 Engineer - - -	50 - -
		4 Coolies on account of machinery at 12 rupees.	48 - -
Present Monthly Expenses - } TOTAL - Rs.	2,495 - -	TOTAL - - - Rs.	1,973 - -

An addition to the salary of the European Overseer who has the responsible charge of tools, materials, &c., of 30 rupees per month is recommended, and I venture to suggest that if the work proceed on the scale proposed, the allowances of the Superintendent be placed on the same footing as those of Engineer officers holding charges of equal importance and responsibility. I consider 2d Lieutenant Hutchinson

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Provinces.

II.—*Above the Falls.*

132. Above the falls of the Great Tenasserim, near a small tributary called Nan their Keung, a mile and quarter from the main river, three small beds of Coal have been observed in sandstone; and about one day's journey lower down the river, thin seams of Coal are exposed in sandstone in the banks.

ABSTRACT of COAL on the Tenasserim River above the Falls.

District.	Field.	Locality.	Beds.
Great Tenasserim	Above the Falls	A small tributary called Nan their Keung, a mile and quarter from the main river - One day's journey lower down the river -	3 small beds in sandstone. Thin seams in sandstone.

III.—*Thian Khan Coal Field.*

133. Eighty miles from Mergui, two-thirds of the distance being open to easy navigation, and the remainder capable of being rendered navigable, inexhaustible beds of Coal of an uniformly good quality occur on the Thian Khan, one of the main branches of the Little Tenasserim. Under the impression that this Coal field was placed beyond the boundary range of our territory, and thereby cut off from access with the coast, the Committee overlooked its importance in former reports. But these geographical errors have been perfectly removed by Captain McLeod.

NOTES—continued.

Hutchinson qualified in every respect to conduct any operations at the Coal field that may be determined upon.

25. It is proposed to raise the Coal from two shafts by means of cattle wheels, which can be constructed on the spot from a model which has been left with Lieutenant Hutchinson. There is abundance of good timber at hand (the Peemah) for this purpose.

Price at which coal
may be shipped at
Mergui.

To be shipped, if possible, from the raft.

28. During four months of the year, from 15th June to 15th October, a steam tug, with tenders lashed alongside, might be usefully employed in conveying Coal to Mergui, and would perform nine trips in the month, but owing to the sudden turns and set of the stream in various places before noticed, together with the shallowness of the water and the rapidity of the current at those parts during the rest of the year, I am unable to suggest any better or more economical method of conveying Coal down the river during that period than by the bamboo rafts hitherto used.

Supervisor of bamboo forests.

30. On the 2d of May I quitted the Coal field. The river had then risen 1 cubit, but it fell afterwards to its former level. The water this year was considered unusually low. Some loaded rafts which had been dispatched on the first rise were, after proceeding a few miles, detained at one of the shallows, and had not arrived at Mergui on the 20th, the day on which I embarked.

Tenasserim
Provinces.

McLeod, an officer of long experience and distinguished service on this part of the coast, who in an able article in the Journal of the "Asiatic Society," proves this Coal district to be within the British territory, and so far from intercepted by any range of hills whatever, that an open navigation extends to within 20 miles of the Coal at all seasons, and that rafts ascend to the Coal itself during the rains.

134. The first bed appears five days' journey above Tenasserim town, exposed on the bank of the Thian Khan river, to an extent of 240 feet, 6 feet in thickness, and dipping at an angle of 20°.

135. Two or three miles above this, a similar bed of Coal, or what is equally probable, several beds of similar size and quality, are observed in 14 different localities, partially exposed on both sides of the river, dipping at an angle of 25°. These beds seem to occur with grey and black slate clay, the latter is supposed to rest on blue limestone.

136. The

NOTES—continued.

EXTRACT of a REPORT on COAL discovered in the Tenasserim Provinces, by Dr. Helfer,
23 May 1838.

Five localities of Coal have hitherto been found in the Tenasserim Provinces, all situated in the province of Mergui.

1st. On the Great Tenasserim, nine days' journey from Tenasserim town, near the creek called Nan their Keungny, one and a quarter mile inland. Species, friable brown Coal intermixed with iron pyrite. Three veins occur in different localities. 2d. Eight days' journey from Tenasserim town, along the banks of the river. Species of lignite and light slaty brown Coal occur in veins, three or four inches thick, &c., vide "Journal of the Asiatic Society," 1838, p. 701.

FROM the REPORT of Dr. Helfer, in the "Journal of the Asiatic Society," Vol. VII. 1838.

On the Coal river, a branch of the Little Tenasserim, five days' journey by water, in a south-east direction, slaty Coal, sp. gr. 1.26 occurs. The bed, six feet thick, 240 feet long, dips at an angle of 20 degrees in the bank of the river. One hour distant an immense Coal field of either slaty or conchoidal pitch Coal occurs, highly bituminous, without pyrites. A succession of 14 localities where the Coal lies bare on clay on both sides of the river occur, running at an angle of 25 degrees, and the river breaking its way through the Coal; in all places six feet or more thick, resting on a stratum of slate.

This extensive Coal field is situated on a high level table land, only diversified by an isolated range of mountains, from which the river passes through the Coal fields. The river is above 15 yards broad, nearly dry part of the year, but uniformly navigable for rafts for five months of the year up to the Coal field.

The Coal itself is of superior quality, being that peculiar species known in England as pitch Coal, which is much higher in price than the common Coal, and on account of the greater quantity of bitumen which it contains, is used for the generation of gas.

A great advantage of the locality is the total absence of land carriage, as the pits are in fact opened by the river. The difficulty of navigation is confined to the last 20 miles, the passage being there obstructed by sunken trees and drift wood.

The last 30 miles being navigable only during five months of the year, it would be necessary to have a dépôt of Coal near this situation, ready to be shipped when the water begins to rise.

A dépôt should also be formed at Mergui, where vessels could easily approach the shore.

The stratum above the Coal is nowhere more than 25 feet, and consists of bad slaty Coal, grey, and debris of slate with coarse gravel and alluvium.

Digging :

a. One person digs in one day 20 maunds, in six days 120, in a year 6,240. Wanted for 10,000 tons, 43 men, say 45.	
One convict at 4 rupees a month - - - - -	$45 \times 4 = 180 \times 12 =$
	Rs. 2,160
b. Working nine hours per day a person transports from the Coal pit (15 feet deep) to the water edge 200 yards distant, in 10 minutes, a cart load. To transport 10,000 tons therefore, 38 men, say 40, are required.	
Being convicts at 4 rupees per month - - - - -	$40 \times 4 = 160 \times 12 =$
	1,920

Transport, on bamboo rafts.

a. Each bamboo raft, 25 feet long by 6 feet broad (double bottom, 2 feet high) holds one ton of coal, 10,000 rafts therefore necessary.	Rs.
b. Two men fill and construct such raft in one day, it is therefore necessary to employ 20,000 men's labour for one day, at 3 a. 1 p. wages per day - - - - -	6,666
c. To load the rafts the same number of men is required as (a. b.) according to the above calculation - - - - -	1,920
d. The river is navigable for five months of the year, from June and to November exclusive. In this time 66 rafts must be dispatched every day.	

e. Going

136. The river is described by the late Dr. Helfer (to whom the discovery is due) as breaking its course through Coal beds of great extent.

These beds are imperfectly described, but they seem to occur with what Dr. Helfer described as grey and black slate clay, the latter being supposed by him to rest on limestone.

137. The various beds appear to be what is called cannel Coal, remarkable for consisting of upwards of 50 per cent. of bitumen, which to use the words of Mr. James Prinsep ("Journal Asiatic Society," 1838, p. 706) "shows it to be a superior blazing material, which is the main point in getting up steam, so much so," he continues, "that I understand one of the company's steamers is unable to get up steam with the Burdwan Coal without a large admixture of English cannel Coal. It also," continued, Mr. Prinsep, "makes an admirable Coal for gas."

Lieutenant Colonel Forbes and the secretary of the Committee were present during Mr. Prinsep's experiments with this Coal, and were equally impressed with Mr. Prinsep himself as to its remarkable superior properties for steam, gas, and coke.

The

NOTES—continued.

e. Going slowly, the rafts arrive during the monsoon in three days, at the junction of the Coal river, with the other forming the Little Tenasserim. To this point two men are required to direct each raft, 10,000 rafts each	Rs.
f. Two men three days' pay from there to the junction of the Great Tenasserim river, going slowly two days' distance. At this place the river is so broad that eight rafts fastened two abreast can be directed by two men.	19,998
1,250 rafts × 2 days at 5 a. 1 p.	1,866
g. From the village of Tenasserim to Mergui, two days (with the tide) 16 rafts can be tied together, directed by two men.	
625 rafts × 2 men, at Rs. 5. 1 p.	933
Pay of the labourers going back by a straight road cut across the jungle.	
Required 20,600 men's labour (each raft two men) three days	20,000

Establishment.

1. One superintendent.	f. Ten miner overseers in coal pits, say 2,000
2. One cashier and book-keeper.	rupees per month.
Two dépôt overseers.	24,000 rupees.
d. One overseer for transport down river.	1,000 rupees, repair of different buildings, wear
e. One overseer for building rafts.	of implements and instruments.
	2,000 rupees, unforeseen expenses.

Abstract.

	Rs.		Rs.
a. Work in the Coal pits	2,160 ×	g. Transport from Tenasserim to Mergui	933
b. Transport to the water edge	1,920 ×	h. Return pay	20,000
c. Building rafts	5,666 ×	i. Superintendents	24,000
d. Loading rafts	1,920 ×	k. Repairs	1,000
e. First three days transport	19,998 ×	l. Unforeseen expenses	2,000
f. Next two days transport	1,866 ×		
		Rs.	82,463

N.B.—1. The employment of convicts by the Government would effect a saving in some of the above items.

Hence 6,000 might be deducted from 82,463 = 76,463—100 bamboo rafts of 25 feet length, fetch in Mergui the price of Rs. 1. 8. to 2 rupees; but say 1 rupee—30 × — 10,000.

300,000 bamboos.

Sale of bamboos - - - 3,000 rupees.

Deducted from 76,463 = - 73,463 "

73,463 rupees = 175,408 annas, divided by

273,170 maunds.

Price of one maund $4\frac{4}{7}$, or $\frac{1}{2}$ anna in Mergui, counting free labour at 10 rupees per month.

First Outlay.

	Rs.		Rs.
Coal in Loco	800	Instruments: spades, 400	400
Dépôt at ditto	400	" pickaxes, 100	100
Dépôt at Mergui	2,000	" crowbars, 40	40
Jetty and quay	1,000	" trucks, 400	1,200
Scales and Weights at the Dépôt	500	Unforeseen expenses	2,000
Buildings for the superintendents	5,000		
		Rs.	13,440

To this must be added the expense of making a direct road through the jungle.

The removal of impediments in the river, chiefly the trees shutting up the passage, which expenses it is impossible to calculate; they cannot, however, be great if convicts are employed.

Tenasserim
Provinces.

138. The following are the results of analysis of four specimens of this Coal by Mr. Prinsep, taken indiscriminately from as many bags. "Journal Asiatic Society," 1838, p. 706 :—

All four burn with copious rich flame, coke close grained, and of highly metallic lustre.

	No. 1.	No. 2.	No. 3.	No. 4.
Water - - - - -	9.7	8.2	7.4	7.6
Specific gravity - - - - -	1.273	1.280	1.245	1.251
Volatile matter - - - - -	45.0	48.9	48.3	48.2
Carbon - - - - -	50.3	66.7	45.1	48.7
Earthy matter, slightly ferruginous -	4.7	4.4	6.6	3.1

Dr. Helfer states the river to be navigable to the Coal, but that only by means of rafts during the rains for five months of the year.

Captain McLeod ascended by water to within eight or nine miles of the Coal; when finding the stream too shallow even for a small raft, he continued the journey by land to the Siamese town, Thian Khan, and from thence to the Coal, crossing several small rivers which discharge themselves into the Thian Khan, on the banks of which the Coal is found.

ABSTRACT of COAL on the Thian Khan, a branch of the Little Tenasserim river.

District.	Field.	Locality.	Beds.
Little Tenasserim -	Thian Khan river -	Near the Village of Thian Khan.	Several beds, 6 feet thick and upwards.

Cuttack Coal
District.

CUTTACK COAL DISTRICT.

139. EXTENSIVE beds of Coal are situated on the Bramini river and one of its tributaries, in the Gopalpashad district. The Bramini enters the Bay of Bengal, near the mouth of Hoogley, not far from Point Palmyral. These beds would appear to deserve, both from their position and extent, more attention than they have received, but the Committee have left nothing in their power untried, with a view to improve their information on the subject.

140. *Talchergurh*.—Seams of Coal appear on the banks of a small nullah, called Balajora, half a mile from the Fort of Talcheer, where a bed 18 inches thick has been found within 13 feet of the surface. Beneath this a grey rock occurs, containing, as well as the shale above adverted to, characteristic impressions of plants of the Coal formation. The Coal is said to be of a good quality and glistening lustre, and to alternate with thin beds of shale.

141. From Talcheer, Coal may be transmitted at all seasons in 10-maund boats to Kumalhung, six miles distant. From thence to Hunsuah, on the coast, it may be transmitted for six months of the year in boats of 100 to 300 maunds, where it may be laid down at three annas per maund, allowing two annas per maund for carriage. Hunsuah affords a safe anchorage for large sloops at least during the N. E. monsoon.

Gopalpashad, Sungurra or Hingolee.

142. Fourteen miles from Talcheer, on a tributary of the Bramini river, which bears one or other of the above appellations, Coal is exposed extensively on both banks,

banks, projecting to an average height of 15 feet above the sand of the river for a distance of a mile.

The country between this and Talcheer is level, affording every facility for the construction either of a road or a canal. For the above particulars we are chiefly indebted to Lieutenant Kittoe.

ABSTRACT of COAL in the Cuttack Division.

Province.	District.	Field.	Locality.	Beds.
Orissa	Bramini River	Talchergurh	Balajora Nullah	1 foot 6 inches.
		Hingolee	Saugra Nullah	15 feet, probably several beds of this size.

B U R D W A N.

Burdwan.

143. **THOUGH** one of the nearest Coal fields to Calcutta, and supplying the metropolis of British India with fuel now for a period of 30 years, we have nothing like a regular account of the beds of Coal it contains.

144. *Singharun Nullah*.—In the bed of this nullah, halfway between the point at which it is crossed by the Benares new road and the Serampore Indigo Factory, or about a mile from the junction of the nullah with the Damooda, a seven-feet bed of Coal is found, of good quality. This bed can be traced as far as Aytwia, where it is intersected by a basaltic dyke.

145. *Barracar*

N O T E S.

FROM Mr. J. Homfray, to the Collector of Burdwan, dated 27th August 1841.

I HAVE the honour to acknowledge the receipt of your favour, covering a copy of a letter from the Coal Committee, requesting information regarding the minerals and ores of this district. I now endeavour to give you a summary of the information which, I believe, is what they require; if it should not be so they can again call upon you and I will try to supply it.

The district of Burdwan, by which is meant that portion which is subject to its judicial and magisterial control, consists of alluvial soil; in the many changes that have taken place in the division of it, and the adjoining districts of Bancorrah or Jungle Mehals and Beerbhoom, it will be necessary for me to include some observations, associated as the minerals are in those three districts, the description of each being so similar, that it ought and really is the same throughout, and the adjoining districts of Chuta Nagpore, or that portion of it which formerly belonged to Ramghur, has a claim to be included therein.

These portions of the above mineral districts have the river Damoodah and Adji intersecting them through the centre, and, with their tributary streams, drain the lands on each side of them; but with the exception of the Barracar river, which is of considerable magnitude, there is not one of them navigable. The Damoodah, which is the largest of these rivers, is, during a period of about 10 weeks, navigable for boats; from the shallowness of the water loaded boats can only descend the stream during such time as the mountain torrents prevail, and which are governed by the quantity of rain in the hills. The same observation applies to the Adji, but which is a much more ungovernable stream, its current more rapid, and therefore the duration of the torrents so short that little time is afforded for boats to descend, whilst at its lower extremity the current is of such strength that it is extremely difficult to stem, and, like its brother the Damoodah, at its higher parts, is rocky and dangerous to navigate. The Barracar, which falls into the Damoodah, is navigable for 12 to 15 miles for boats of 200 maunds burthen; the highest point to which the Damoodah is navigable is to Ghauteale, above which place there are rapids and rocks which completely impede its navigation.

Quitting the plains, the first place where the alluvial soil changes is near Furredpore jungle, through which the new road to Benares passes, and in its centre the Dawk Bangalow of Kyrasole is placed, and to which there is a gentle ascent of four miles from the alluvial soil, and passing over a red-coloured soil, with a conglomerate sandstone occasionally protruding; a line thence across to the Adji due north may be taken as the eastern boundary of the mineral district, although nothing is found until on the new road we come to the Singharun nullah, which stream falls into the Damoodah, near the Serampore Indigo Factory; between this point and that river nothing is found, but one mile northward we come upon the first outcrop of the Coal field, and which mineral is found in the stream for considerable distance, the vein of coal being about seven feet in thickness, and of good quality; a person continuing along the road to the Barricar river will in several places perceive the outcrop of several small veins of coal, and when within two miles of the Barracar river will find himself on the ironstone measures, which are there exposed to the day for a great distance,

Burdwan.

145. *Barracar River*.—A bed of Coal, eight or nine feet thick, is found on both banks of the Barracar river at Burmury.

146. *Damooda*.—About seven miles above the confluence of the Singharra nullah with the Damooda, and on a little nullah called Mooneah, the collieries formerly worked by Gilmore & Co., Mr. Homfray, as well as those of Carr, Tagore & Co., are situated close together. The latter is called Ranee Gunge.

The bed worked in these three collieries is the same, 90 feet below the surface, and nine feet thick, the superincumbent beds being sandstone and shale.

147. *Salmah*.—On the Damoodah river, five miles above Ranee Gunge, a deep pit is said to have been sunk with the intention of coming upon another bed of Coal seven feet thick, observed in the vicinity.

In

NOTES—continued.

until he arrives at the Jeyn temples at Bojooneah, where the Barracar is crossed; there are three veins of ironstone, but all of them two to three inches thickness, and the mine itself poor in metal. I apprehend it was from these beds the greatest portion of the iron worked by the natives in former days was obtained, but at the present day not one pound of iron is manufactured east of the Barricar river.

These very well defined measures first rise out of the river about a mile south of the Bozooneah, and continue northward, through the country, exposed in very many places, until it reaches fairly over to the Adji, where they are seen so low down as Hidgelegureah Hill; these measures are the best guide to all investigations into the course of the minerals in that part of the country. Returned to the Singharum nullah, the vein of Coal there found can be traced at its northern outcrop generally at one to two miles' distance from the new road, as far as Aytwia, until it is intersected by a very large basaltic dyke, when it is lost; its place in the mineral field is then supplied by the before-named ironstone measures, beneath which there is another very fine vein of Coal eight to nine feet thickness. *This vein is found on both banks of the Barracar river for some distance, and over the Adji; it is succeeded by sandstone, and soon afterwards wedges out against the schistose rocks, which form one immense mass of hills to Curruckpore, near Monghyr, returning to the Damoodah; at the junction of the Singharum nullah, about two miles upwards, the first sandstone rocks are found on the banks of the river; but proceeding higher up this river to a distance of seven miles to a little nullah, named Nooneah, the collieries of Messrs. Gilmore and Homfray, and Messrs. Carr, Tagore are situated close to and adjoining each other, the latter bearing the name of Ranee Gunge, from its proprietary rights having been invested in the late Ranee of Burdwan, and it is from which circumstance the erroneous name of Burdwan collieries takes its origin, since it is not within many miles of the Burdwan district, the most appropriate name is the Damoodah Coal valley.

The vein of Coal at these collieries is about nine feet thick, and is won at a depth of about 90 feet, the superstrata being sandstone and black shale, such as is usually found to accompany the mineral in other countries—proceeding upwards, there is Coal found on the banks of the river but of worthless quality; and at Salmah, five miles higher up the river, a deep pit is sinking, and has been in operation for some years past, with an intention of sinking down to another thick vein of Coal of seven feet, which has been ascertained to exist in another part of the country. In sinking this pit (at present August 1841), to a depth of above 190 feet, no less than six veins of Coal have been passed through, varying in thickness from 18 inches to 2½ feet, but all of them inferior in quality; it is expected that the main vein will be met with after passing through one more vein of Coal. Only one vein of ironstone has been passed in that pit—the strata are of sandstone, of very hard nature, similar in every respect to that in England which accompanies Coal, and very dissimilar to that at the lower collieries before named. At 12 miles higher up is the China Coory Colliery upon a vein of seven feet thickness; the same vein is found on both banks of the river, and is largely worked by Messrs. Carr & Co. at four different collieries. About five miles above China Coory is the junction of the Barracar river, at which place numerous faults, traceable to the neighbouring mountain hill of Pachite, which is about three miles south of the river, dislocate the strata, often throwing them not only out of their usual course, but uplifting them so that other veins of Coal are brought to the surface, and which are found and worked up the Barracar river, thence across the country to the Adji and into the Beerbhoom district, where for many miles Coal and traces of it are found beneath the hills which run towards Rajmehal. Coal is also found in many small rivers beneath those hills, but everywhere of very inferior quality, and from its proximity to those hills, which are evidently of igneous origin, the field in that country must always be precarious.

At a few miles from the union of the Damoodah with the Barracar river, a fine vein of Coal has been thrown up by one of those great faults above alluded to, and it has lately been commenced to be worked by myself. Its quality is superior to any of the other veins hitherto worked, and its thickness, about eight feet, makes it a noble addition to the Coal resources of this valley; it is difficult to be brought to the navigable part of the river; the colliery is yet in its infancy, and may yet be given over. The limit of this vein of Coal is extremely confined, it being again lost as it approaches towards the schistose hills of Panraid; it is situated within the Chuta Nagpore district. Proceeding up the Damoodah, coal is lost on its northern bank, except where in one place it is thrown up by a fault, and where the whole extent of workable Coal cannot exceed two to three biggahs, or about one acre upon the south bank. The China Coory vein is found and worked by Messrs. Carr & Co., and it is traceable all the way to Ghautcale, which is six miles above the union of the two rivers, and where the navigation ceases. Coal of excellent quality and good thickness is found some way above there on both banks, but its distance from the navigable part of the river precludes its being worked at present. The Coal continues and is found for full 30 miles higher up this river, adjoining to Ranighur, and is a continuation of the same extensive Coal field of the Damoodah; returning.

* The Barracara or
Bunnoory coal.

In August 1841, a depth of 190 feet was said to have been attained. In this work six beds of Coal were penetrated, each varying from 18 inches to 2½ feet in thickness.

148. *China Coory*.—On the Damooda, about five miles below the confluence of the Barracar with the Damooda, and 12 miles higher up the latter river, a bed of Coal is said to have been extensively worked by Carr, Tagore, & Co.

ABSTRACT of COAL in the *Damooda* District.

District.	Field.	Locality.	Bed.
Damooda - -	Singharun Nullah	1 mile from the junction with the Damooda.	7 feet.
	Barracara - - -	Burmury - - - - -	8 or 9 feet.
	Ranee Gunge - - -	7 miles above the Singhara Nullah -	9 feet.
	Salma - - - - -	5 miles above Ranee Gunge -	7 feet.
	China Coory - - -	Within 5 miles of the confluence of the Barracara.	7 feet.

149. The various parties who hitherto worked the principal mines on the Damooda, are now united as the Bengal Coal Company, with the exception of Mr. Erskine and the Doba Company, who have each separate collieries on their own interests.

150. The average annual expenditure of Burdwan Coal for the public use for the first four years after the introduction of steam navigation in 1828, was 83,226 maunds. The expenditure for private use may have been about as much more; making the total expenditure then about 1,66,452 maunds per annum. The average expenditure of this Coal during the past four years may be taken at about 12,00,000 maunds, being an increase from 1830 to 1842 equal to 6,007 per cent. per annum.

151. Taking the present expenditure of Burdwan Coal at 17 lakhs maunds, and its probable annual increase during the next five years at half the foregoing ratio, allowing the other half to be supplied from new sources, the expenditure of Burdwan Coal would at this rate, for the year ending in May 1850 amount to 63,11,961 maunds.

152. The

NOTES—continued.

returning down to where the first traces of sandstone are found, near to Serampore, we find on the south bank of the Damooda, at a distance of about two to three miles, a range of hills of igneous origin, in reality of all compositions, of granite, porphyry, and all the sub-divisions of granite. This range runs parallel with the Damadoo when in a line with the collieries; we find the first basaltic dykes issue thence, and the whole of them, which are very numerous, can be traced to that source. Beneath these hills, in many places, a white porcelain earth, in character the same as the Kaolin of China, is found, and from which I had some coarse pottery moulded in England, but it was pronounced to be unfit for fine ware; between the river and a place called Mulliary it exists in quantity, and there is also much found in other localities towards Bancoorah. Accompanying the Coal is also found very good fire clay, and from which firebricks are constructed by Messrs. Jessop in Calcutta, which they use occasionally in their iron melting furnaces; it requires much care in the selection. Near the Gautcale is found the plates of talc, but it does not raise in pieces of sufficient size to be of any value above the ordinary description elsewhere found; so also under the Beerbhoom Hills I have found talc.

To the south, towards Burraboom, we have a very poor description of copper ore; it is even now worked by stealth. I doubt the ore vein being sufficiently rich to warrant any extensive work thereon. It is found on both sides of the Subanreeka river, and lies in the same schist rocks which like those I have described as existing in the upper divisions of the Barracar river.

Of iron ores differing from the clay ironstone which accompanies the Coal, there are many localities, all of them in the midst of those hills which run parallel with the Damooda to the south, particularly near to the large hill of Sasooneah and between it Beharynauth Hill, and it exists all the way towards Ramghur. Iron is smelted in those localities, but no steel is made.

Lead ore is found in the Beerbhoom and Bhaugleporc Hills, near to Devgur, where it has been long known. Some years since I found it also to exist at Doomka in the hills, about 30 miles north-west of Beerbhoom. It is very poor, at least as far as I found it, sinking only to a depth of 35 feet; it is worked occasionally in several places near to those two places. Mineral springs of hot water are very numerous above the junction of the Barracar and Damoodah river, mostly sulphurous.

Some years since several small parcels of gold dust were procured from washing in the bed of a river, but it never could be traced to any exact spot, although many endeavours were made by Mr. Hopner and myself. It is near to Loonkoo Toomranah, which is near to Toree. It has, I understood, been latterly noticed by Captain Wilkinson, late political agent in that division of Nagpore.

The above is an outline of the mineral feature of these parts. My large map and survey, although I have been gradually adding to it, is yet very far from complete, and is, of course, not in a state to

Burdwan.

152. The distance of the nearest mines from Calcutta is about 90 miles in a direct line, without any impediment to the most improved means of transit. But the circuit by which the Coal is carried down the Damooda is 200 miles nearly, and that at an expense of 10 rupees per 100 maunds for boats, and an equal sum for the expense of large depôts at the foot of the rapids of the Damooda, and for wastage and loss of boats; thus making the present expense of carriage 20 rupees per 100 maunds, or 3 *a.* 2½ *p.* per maund nearly, which at the present annual expenditure of 17 lakhs of maunds is 3,40,000 rupees. In five years, supposing the expenditure to be 63,11,961 maunds, the outlay for carriage alone to Calcutta would be 12,62,392 rupees.

153. It may be worth considering whether so large a sum (annually increasing with the demand of Coal) be well spent for boats, and whether it produces a corresponding improvement in the boat trade on the Damooda. In 1832 there were two tenders offered for the supply of the public expenditure of Coal, the general expenditure of the article being then ¼th of what it is at present.

154. One of these tenders was at 6 annas, the other at 5½; yet notwithstanding the great increase of demand, it may be doubted if the average cost of Burdwan Coal in Calcutta is now much, if at all below 5 annas; and as 3½ annas go for carriage, we may perhaps conclude that, without some better means of delivery than the present state of the Damooda affords, the increased demand for Burdwan Coal cannot be attended with any very material reduction in price in Calcutta.

155. With regard to the Coal trade on the Damooda, the floods in the upper part of that river, and the danger, risk, and uncertainty to which they give rise, are all incompatible with that steady improvement which should attend this branch of industry; so long, therefore, as the Damooda is the only means of delivery, the degree of enterprise directed towards the Burdwan mines must be comparatively limited.

The present difficulty of access being such as to deter new parties from entering into competition with those already in possession of the field, the remedy would be to improve the means of access to it.

1st. Either by a canal on the Adji;

2d. Or by connecting the Damooda directly with the Hoogley at Calcutta, provided the upper part of the river above Burdwan be capable of improvement;

3d. Or by railroad.

NOTES—continued.

exhibit. You will perceive that I have dwelt more on the River Damooda than upon the Adji, although Coal is found on its banks and also in various localities near to it; but that ungovernable torrent prevents any use being made of those Coals which I know exist there in abundance.

The late Mr. Jones who commenced the colliery now belonging to Messrs. Carr and Co., drew up a report, which I need only state is calculated in every way to mislead, it is extremely erroneous as far as the colliery part is concerned, and which was its object to illustrate, and not worth relying on. I wish that this outline may be of any service to the inquiry; much more might be added, but as an outline is required so I sent it. You will see that at this time the following collieries are at work; a general opinion prevails that only two collieries exist; here is a list of workings, some of which as noticed are only on the surface or crop Coal:—

1. Mungulpore at the E. commencement of the Coal field on the Singharum nullah, at present stopped and only lately commenced, is five miles distant from Damooda, belongs to Mr. Erskine.

2. Mamoodpore, about two miles higher on the same nullah, is surface Coal, is carried on carts to the Adji six miles, belongs to Mr. Blake.

3. Agarah.—Carr and Co., originally Mr. Jones, and called by him Raneegunge.

4. Narain Coory.—Gilmore and Homfray, adjoining to the above.

5. Damooleah.—Carr and Co., originally Jessop, an open surface Coal, one mile from No. 3.

6. Damarah.—Ditto, surface Coal near the bank of Nooneah nullah, five miles from No. 3 on same bank.

7. Salmah.—Homfray, in progress of sinking, five miles from No. 4 on south bank.

8. Choonparah.—Gilmore and Homfray, ditto, nine miles on south bank from No. 4.

9. China Coory.—Carr and Co., formerly Betts, 18 miles from No. 3 north bank, also a main worked on the opposite bank.

10. Dhee Sherghur.—Ditto, three miles above No. 9, a surface work on the bank.

11. Narainpore.—Ditto, six miles above No. 9 on south bank.

12. Barracar.—Gilmore and Homfray, new colliery, 28 miles from No. 4, at work and promises excellent Coal under a good depth of ground; this is in Chuta Nagpore district.

13. Burmoory.—Juggernat Doss on the Barracar river, not working at present; in fact, Nos. 3, 4, 9, and 12 are the main collieries, the others being out of work.

There are at and near to Cherooleah on the Adji river, very extensive quarries of coarse sandstone paving flags, but they are inferior in texture and grain to those obtained from Chunar. Whilst at Muddenpore from large quarries of schist, plates, dishes, and stoneware are manufactured, and cut and sent down for sale by the Barracar river.

A D J I.

Adji.

156. The first mines we come to on ascending the Adji river are situated 12 miles above Elambazar, or about 47 miles from the confluence of the Adji with the Hoogley at Cutwa. For a distance of 60 miles to the west of Elambazar, the country on both sides of the Adji river, is one extended Coal field. But it is not until we have advanced into the hills where the surface becomes broken and elevated, that the beds of Coal are laid bare and exposed in ravines and other natural sections.

157. *Churalya*.—Situated on the southern bank of the Adji, at a distance of 60 miles from Cutwa. A six feet bed of Coal here occurs within a quarter of a mile of the river. A section of the place is formed by a small watercourse, showing the Coal to be covered by 13 feet of soil. Beneath, it rests on 23 feet of sandstone, which becomes soft by exposure. This sandstone is intersected every two or three feet by thin seams of Coal and shale.

158. *Mahudnuggur*.—On the opposite or north bank, three-quarters of a mile from the river, and not above a mile from Churalya, a bed of Coal 13½ feet, also exposed by a watercourse, is seen covered merely by six feet of hard clay.

159. *Mammudpore*.—Coal is worked by Mr. Erskine in two places at Mammudpore, two coss south of the Adji Ghat at Seedpoorie.*

160. *Pariharpore*.—A good deal west of the Mammudpore, only four miles from the Damooda, and eight miles in a south-westerly direction from the Adji at Durbadanga Ghat, Mr. Erskine works a bed of Coal which rather belongs to the Damooda than the Adji basin.

ABSTRACT

NOTE.

* To the west of this, the extent and quality of the Coal improves, but we have no scientific particulars whatever as to the peculiarities of the different beds that have been penetrated. Mines are now opened on the Adji side by the Dhoba Company, by Mr. Erskine, and by Mr. Hollings and other parties, we believe under the denomination of Beerhboom Coal Company.

With regard to the quality of the Adji Coal, it may be sufficient to state the result of two trials. Two hundred maunds of the Churalya bed were tried at the Mint, the result was that 28 maunds from this bed were found to be equal to 25 maunds of the best Burdwan (*vide* Proc. Committee, 11th January 1842, paragraph 3,) from Mr. Erskine's mine, 13 miles below Churalya. The daily consumption in a 20-horse power engine was found to be 27 maunds 14 seers, leaving 24 per cent. of ashes; 29 maunds 9 seers of Burdwan Coal were required daily to keep the engine to the same work, leaving 25 per cent. of ashes. (*Vide* Proc. Committee, 6th December 1841, paragraph 2.)

Boats of 200 maunds burden can ascend the Adji to Elambazar in the rains. Beyond this the country affords every facility and excellent material for the construction of good roads.

Plans have been suggested for improving the Adji river, but Colonel Forbes is of opinion that a canal six feet deep extended parallel to the stream would be cheaper. (*Vide* Proc. Committee, 4th October 1841, paragraph 8.)

Sixty miles of canal on the Adji river would save 200 miles in the carriage of Burdwan Coal to the upper parts of Bengal, and 100 miles in the distance it is now carried to Calcutta. It would also obviate the necessity of keeping up a two years' stock at Omptah to guard against contingent demands that might arise after the navigation of the Damooda closes, whereby the quality of the Coal deteriorates. The saving of 100 to 160 miles of carriage, together with the loss and expense of depôts, both estimated at two annas per maund, would allow of a toll to that amount on the proposed canal.

The present expenditure of Burdwan Coal may be estimated at 15 lakhs of maunds, which at two annas toll per maund, would yield 1,25,000 rupees per annum on the proposed canal for Coal alone, which at 5 per cent. would admit of an outlay of 25 lakhs, or 41,565 rupees per mile for a distance of 60 miles.

We do not take into account the other uses of a canal on this line; but for the mere conveyance of Coal alone, it is evident it would pay even at the present rate of expenditure. But the expenditure has trebled itself within the last seven years, and may go on increasing at the same rate, so that the return in seven years on Coal alone might be reckoned with tolerable certainty to be 15 per cent. The great public benefit of such a work would consist in effectually opening the Burdwan district, and destroying the present monopoly on the Damooda, which is directly opposed to public improvement in the supply of Coal.

Adj.

ABSTRACT of COAL in the *Adj*i District.

District.	Field.	Locality.	Bed.
Adj <i>i</i> River -	Churalya -	{ Quarter mile from the south bank of the Adj <i>i</i> - - - }	6 feet.
	Moheednuggur -	{ North bank of the Adj <i>i</i> , three- quarters of a mile from the river - - - }	13½ feet.
	Mammudpore -	Two coss south of Seedpore -	Size not stated.

Rajmehal.

R A J M E H A L.

161. *Bansli River*.—At the pass of the Patchwarry on the Bansli river, 30 miles from its confluence with the Bhagarutty near Belgotta, Coal has been for the last 30 years known to exist without eliciting any inquiry.

Meanwhile the necessary supplies for the public steamers in the vicinity are carried a distance of 600 miles at a heavy expense.

Doobradgepore.—On the Bramany river, 15 miles south of Patchwarry, Coal is found in various situations for a distance of 15 miles on both sides of the river. It is still unexamined notwithstanding repeated urgent calls of the authorities on the spot for proper aid. The Superintendent of the Nuddyah rivers was suggested as a likely person to improve our knowledge on this subject from his vicinity to the place. He was therefore requested to visit the spot. (See Proceedings, 6th January 1841, para. 15.) The season being too far advanced before the request was communicated to him, he could only send persons out

NOTES.

LETTER from Mr. *James Pontet*, to the Secretary of the Coal Committee, dated 10 November 1838.

I HAVE the honour to acknowledge the receipt of your letter, dated the 19th October, and herewith I send my reply to the different paragraphs.

Para. 1. At present only one bed of good Coal has been discovered (in the Rajmehal Hills) by me, 400 maunds of which has been forwarded to your Committee and its arrival acknowledged by Captain Forbes, under date 22d September last; the above bed is 16 miles from a navigable river four months out of the year.

Para. 2. The best dépôt for the Coal is at Coytah, 24 miles western from Moorshedabad on the Brammany nullah, accessible from June to September, for boats of 100 to 500 maunds burden. Flat-bottom boat would be desirable, but I think sufficient country boats from 70,000 to 80,000 maunds are procurable from Moorshedabad. I cannot at present state what will be the cost per maund, as it will have to go 16 or 20 miles by land, which I have not yet had a trial of; however, I do not expect the Coal will cost more than six annas a maund at Berhampore, it will all depend on what the land carriage costs; the boat hire is 10 rupees per 100 maunds to Berhampore.

Para. 3. No parties are engaged working Coal mines in this neighbourhood, and the best mode of bringing the mine into operation would be, I think, first to discover the extent of the bed, the quality, and the actual cost per maund landed at Berhampore; with this information tenders might be invited to supply the different dépôts. The mine is so far from this station, and only to be visited by Europeans from December to May, that I cannot give any more particulars until I go out, which will be next month. If the Government will allow my son the pottah of the mine for its discovery, I shall be happy to exert myself to obtain the above information, and raising as much Coal as possible from January to May, and send it to Coytah.

From the same to the Secretary of the Coal Committee, dated 22 March 1839.

I HAVE received your favour of the 29th January, which I would have replied to earlier, but was in hopes to have had some satisfactory information to convey to the Committee. Agreeable to my letter of the 29th December, I proceeded to the mine, and was in that direction all January, set the kulashies with boring rods at work, and found the vein to run to the N.W. of the Brammany nuddy (25 feet below the surface). The rods have not answered my expectations, they appear of too light a kind for a strata of stone; after the first vein of Coal, we came upon a hard

out to make inquiries, the result of which would regulate his own movements ; since which time however the Committee have heard nothing more on the subject.

Rajmehal.

162. *Hurrah*.—Detached masses of Coal were collected on the surface at Teermohun and at Hurrah, and transmitted to Calcutta for trial in 1831 ; neither the circumstances nor the locality were described at the time. The only information to be gleaned from the correspondence on the subject is, that 1,000 maunds were transmitted to Calcutta, and found to be unfit for steam.

163. *Mootee Jarma*.—At the village Moharajepore, near the Mootee Jarma, or waterfall, Coal was found, and samples transmitted to Calcutta in 1831, but no description of the locality having been at the time communicated, recent attempts to refind it have proved unsuccessful. The Coal was considered inferior.

ABSTRACT

hard black stone, and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers and stonecutters from Narrainepore, who have been the last two months at work ; at present to all appearances satisfactory ; as one of the men among the stonecutters (who opened a shaft at Burdwan) says this mine bears the same resemblance to it, I am induced to persevere a few feet more, in the hopes of coming to a useful vein ; the first 23 feet of soil is red and black earth, mixed with kunkur (from sample 1 to 4), and under that, to the depth of 40 feet, are 13 different stratas (three of Coal, and the rest various kind of stone), vide 5 to 17 (from the samples forwarded this day for the steamer passing Rajmehal) ; may be your Committee will be able to form an opinion whether it is likely I shall succeed in coming to a good vein. The last despatch made to you was at the mercy of natives entirely, the season being so far advanced when it was ordered, and it is more than probable to have had some from the surface, which your Committee complains of. I could, from along the banks of the river (if required) procure 5,000 or 6,000 maunds of good Coal, but as I have discovered that the vein is of not sufficient depth to work, so I conclude your Committee would not wish it. Certainly no reliance can be placed upon my discovery for the ensuing season ; if I come upon a good and deep vein, as expected, in a few days, I shall extract as much as I can before the rains. The boring-rods have been applied in seven different directions, and the vein appears to run more westerly than otherwise. Unfortunately the two kulashies who accompanied the rods have both been laid up with jungle fever, which has retarded their operations greatly for the last month ; they will commence again in a day or two, when I hope to be able to report how far the vein does extend ; at present we have only found it 300 yards as from the river, and three quarters of a mile wide. I shall feel obliged if you will inform me whether your Committee approve of my proceedings, and to what depth may I carry the shaft ; the stonecutters inform me before they come upon the present vein (working at Burdwan) they had to penetrate through 30 feet stone. The expenses now incurred consist thus of—

	Rs.	a.
4 Stonecutters	22	—
15 Coolies for the shaft	45	—
1 Sirdar	4	—
2 Peons	5	8
12 Coolies for the rods	24	—
	Rs.	100 8 per mensem.

I have paid to this date Rs. 607. 11. 4. on account of the Coal mine, &c., and beg to enclose the account, which I hope will be found satisfactory ; by it you will perceive I have unexpectedly exceeded the sum sanctioned by your Committee, but being a trifle to gain such an object, I trust you will use your interest to get the balance sanctioned, also an additional advance should the Government wish the present operations to be continued. An early answer will greatly oblige.

From the same to the Secretary, Coal Committee, dated 13 May 1839.

I HAVE wished to acknowledge the receipt of your favour the 4th ultimo before now, but owing to the dreadful sickness (jungle fever) in my establishment (four men having died), I have not been able to send those particulars I thought would be acceptable to your Committee. Shortly after the receipt of your favour, I sent to forbid the men extending the excavation, which they had previously done from the water coming in too quick upon them. I had a "Mhate" at work, but it would not keep the well free, to admit of the men working ; my want of experience in sinking a shaft properly has been a great bar to completing my discovery this season ; the men are so sanguine that the vein is not more than two or three feet off, that after the rains I shall prosecute my attempt by making the well long instead of round, so as to admit of more men working. During the ensuing rains I hope to procure leave of absence to visit Burdwan, when I shall make myself acquainted with the different appearances of the strata above the vein in that quarter.

Agreeable to your Committee's request, I have returned the boring-rods (on the 4th instant), addressed to Colonel R. Powney ; expense of the boat hire and carting has been 23 rupees, which I hope you will remit me at your earliest convenience, as well as the balance of the former account.

Rajmehal.

ABSTRACT of COAL in the *Rajmehal* District.

District.	Field.	Locality.	Beds.
Rajmehal	Bansli river	Patchwarry Pass	In Sandstone.
	Braminy river	Doolbradagepoor	{ Numerous beds not described, alternating with sandstone and shale.
	Teermohun	Hurra	Not traced.
	Sicrigully	Mootee Jarma	Not traced.

Palamow.

PALAMOW.

164. WITHIN 30 miles of the Soane river, and about 100 miles in a direct line from the confluence of that stream with the Ganges, numerous beds of Coal exist. They all lie in the valley of Palamow. The Coal districts in the vicinity of this valley are as follows :—

- I. Hotar, in the upper part of the valley.
- II. Singra or Sidra, in the middle part of the valley.
- III. Gorossan Nullah, five miles beyond Chapari.
- IV. Rajhara, on the Sodabah Nullah.

The

NOTES—continued.

The bed or field of Coal has been traced a mile south-west of the Brammuniy river (in Belputtu); and I am inclined to think it is a continuation of that in Burdwan. I have likewise traced it 15 miles to the north-west, between the Brammuniy and Hurrah, where Captain Tanner some years ago opened a shaft. From the different specimens of earth, Coal, and stone I forwarded to you by the steamer in March, your Committee can inform me whether I should be successful in tracing the vein, if I proceed in the excavation.

TRIAL of Rajmehal Coal sent to the Mint by Dr. *M'Clelland* on the 31st May 1841.

THE steam having been got up in the first instance by English Coal, and on the engine being started, the firing with the Rajmehal Coal commenced, and during the time it was used the steam was kept up to full force; the fire had a good blaze, and the fire-bars admitted a bright ash pit.

The Coal submitted for experiment, weighing 13 maunds 3 seers 0 chittack, worked the Mint 20-horse power steam engine 2 h. 50 m., being at the rate of 4 maunds 24 seers 9 chittacks per hour, against 3 maunds and 5 seers of the best Burdan Coal expended per hour on the same engine, and working under similar circumstances.

(signed) *W. N. Forbes*, Mint Master.

2 July 1841.

REPORT on Mr. *Pontet's* Coal sent to the Mint by Dr. *M'Clelland*, Secretary to the Coal and Iron Committee, on the 10th January 1842.

THE Coal having been tried at the Mint 20-horse power steam engine, it was found that it failed to keep up the steam; and in consequence of the frequent stoppage of the engine it became necessary to discontinue the experiment. The Coal appears greatly inferior in quality to that sent at a previous period to the Mint by Mr. *Pontet*.

(signed) *W. N. Forbes*, Mint Master.

7 February 1842.

EXTRACT of a LETTER from Mr. *W. B. Tytler*, Superintending Engineer Steam Department, dated 22 September 1839.

THE only obstacles to the free navigation of the Soane may be summed up in a few words, viz.: currents to ascend against running 12 miles and upwards an hour, with channels cross, variable, and tortuous, eddies wheeling in all directions, and the water in this river constantly rising and subsiding, as it is more or less affected by the mountain torrents and the overflowing of its tributary streams, in the higher ranges of hills in Palamow. These obstacles are to be considered by no means

The beds are of good workable size, some of them are large and situated on the banks of the Coyle river or its tributaries; the quality of the Coal, as far as it is known, is heavy and inferior, but from some beds it is better, and from others very good.

The Hotar bed, situated in the upper part of the valley, is the least accessible, access to it being intercepted by a range of hills which interrupt the navigation of the river for some miles. This is the more to be regretted as the bed thus placed is of unquestionable superiority.

The other beds in the middle and lower parts of the valley are all within reach of water carriage, with more or less difficulty, perhaps, for a distance of 15 to 20 miles.

I. *The Upper Palamow or Hotar Coal.*

165. The place at which Coal was first discovered in Palamow, is indicated on Arrowsmith's large Map on the west bank of the Coyle river, at a point 50 miles from the conflux of the Soane. Major Sage, who visited the place in 1830,

NOTES—continued.

means insurmountable: but the time consumed in ascending the Soane with boats of any considerable burden, will act as a serious drawback to the profitable navigation of this rapid river.

Regarding the local situations, where I experienced the greatest difficulties in ascending the Soane, I beg to submit that between Maneah and Daudnaghur the stream was so strong as frequently to defy our united efforts to get ahead at all; and I was obliged on several occasions to call in the aid of the villagers to pull up the vessel with ropes. This plan answered very well where good footing was obtained on any of the high banks; but when obliged to track on sands in following the channels, the boatmen became tired and dispirited by getting into quicksands, and in consequence my progress upwards was the more retarded as their fears prevailed. From Daudnaghur to the Benares road we had a rise of the river; but being favoured with a slight easterly breeze, this compensated for the increase of water, although our progress upwards was not at a more rapid rate than the foregoing days.

From the Benares road to Bundoo Ghaut the river subsided, and the breeze freshening at the same time, our vessels made more way: but the river rising again as we neared the Amirkah chain of rocks at Bundoo, and the stronger currents setting direct over them, I deemed it advisable to take the eastern channel, being the safest of the two; but even through it I was obliged to warp up with the light anchors of my pinnacle, the anchors being carried ahead by my pilot dinghee. This is the most rapid part I met with on the Soane; it is not so much owing to the declivity of the bed of the river, as to the water being confined into a narrow space, by the obstruction of the rocks on the western bank, extending out nearly to the middle of the river's bed. From Bundoo Ghaut to the mouth of the Coyle, although so short a distance, owing to the sudden subsiding of the Soane, we experienced much difficulty in getting out of the upper end of the eastern channel, partly for the want of water, but chiefly owing to the undefined nature of its numerous inlets, and its broad shallow entrance. On the 27th August, just as I had entered the mouth of the Coyle, about 4 p.m., I determined on proceeding on up the Coyle in my 200 maunds' dinghee.

The average depth of the water in the Soane I found to vary from 6 to 20 feet; and at no part, so far as I have seen, would a steamer have the slightest difficulty of navigating this river as high as the Coyle, provided she had power to steam the rapid currents.

I found the water in the Coyle between its junction with the Soane and Garia Ghaut, flowing at about the same rapidity as that of the Soane; and the same remarks apply generally regarding cross currents and eddies, but so uncertain is its rises and falls, and so sudden and frequent do they take place, that no certain depth of water can be found in its channels throughout the rainy season. From Garia Ghaut to Mangeowah, and thence to Seeckseekie and Maugean, villages on both sides of the river, the Coyle runs over a rocky channel at an increased rapidity, and to an extent about one-third of the bed of the river; but the other two-thirds lying higher along the south-west bank, the water is wholly confined to this rugged course, to navigate through it is a difficult task as it is at present; but if the chief rocks now in the way were removed by blasting, no other obstacles whatever is found to prevent or obstruct navigation on the Coyle as high as Shapore, six miles above Singrah in Palamow.

EXTRACT of a LETTER from Captain W. Sage, dated 27 April 1836.

In visiting the place marked "Coal mine" in Bannel's Map, No. 8, I found a village called Hotar; and at some distance up the Barra river, an extensive bed of Coal in every respect the same as the bituminous Coal in the Gorassan, lay exposed to the eye. In the neighbourhood of the Coal beds grows the saul; I measured one tree, which at three feet above the ground was found to be 14 feet 7 inches in girth, and which rose from 40 to 50 feet without a branch. Iron is found in great quantities, as also numerous granites. Extensive mango topes, with other signs of villages and cultivation, convinced me it had once been tolerably peopled.

The country is rich in cattle, particularly in a small breed of sheep like the Welch, having very fine wool, blankets from the country are consequently in request; grain on bullocks is exported

Palamow.

1830, found the Coal to be in every respect like that of the Gorossan, rich and bituminous. Iron is found extensively with the Coal, and the country, where uncultivated, is covered with extensive forests of saul, some of the trees measuring 14 feet in circumference. The country is also rich in cattle used for the transport of grain, so that there is nothing wanting, Major Sage remarks, but roads and water carriage, to render Palamow a rich district.

Mr. Homfray, who visited this district in 1837, reports the upper field to be about 14 miles in length and 6 in breadth, and to contain a main bed of Coal 3 feet 9 inches thick, of good quality. Unfortunately, the navigation of the Coyle is obstructed for 13 miles before reaching this Coal, which must therefore, in the present state of things, be regarded as inaccessible.

ABSTRACT

NOTES—continued.

in considerable quantities. Gram, wheat, and barley were selling at 100 seers for the rupee; the rivers abound in trout and other fish, and nothing is required to make Palamow a rich mercantile and manufacturing country, but roads and a water communication direct with the Ganges.

To bring the Coal into use I would propose to throw a stone bund about 60 feet at the top, of granite, so as to form a reservoir across the Coyle at Garia Haut, basing it on the gneis rock, which in the dry weather is perceptible quite across the stream. I would propose a cut across the tableland into the nearest branch of the great Pompon river, which should be levelled and locked all the way to the Futwah Bridge below Patna; this would form a capital dépôt for the steamers, and eventually realise a considerable saving to Government.

Another way to get down the Coal, &c., would be to blast the rocks at Garia Ghat and Maugean, which would deepen the river and give it during the rains a free communication with the Soane, and by this river with the Ganges at or near Moneah. A young engineer should be sent to survey the country and lay down a line for a canal, as the most advantageous way of bringing the resources of that extensive tract of country into play. The extent of the cut it may be necessary to make will be trifling.

The advantages accruing to the Government from the establishment of such a communication are obvious. A country almost depopulated, and yielding little or no revenue, would speedily teem with people and commerce; the minerals, now valueless from their inaccessibility, will be brought into the more civilised districts, proving a source of wealth to all parts of the country; and the arts once introduced into Palamow and its neighbouring districts would extend their influence through the countries of Sirgaunah, and readily open for themselves a passage into the states of Hyderabad and Nagpore, more particularly if the new road intended by our late Governor General, Lord William Bentinck, from Midnapore to Nagpore, and on to Bombay, should be constructed.

Steamers will soon be found on the Jumna as high as Delhi, and on the Ganges as far as Gurmuckteeser, and immense will be the saving to Government in having a Coal dépôt at Futwah, only a few miles from Patna, and from which the whole of the western stations may be supplied.

I have thrown these remarks hastily together in consequence of your questions to me regarding the Coal countries of Palamow, and from a conviction of the great capabilities of the neighbouring districts, nature having bestowed on them all the requisites for a manufacturing country, and leaving to art the single operation of opening a water communication.

EXTRACT from a REPORT on the Coal Fields of Palamow and Amanath, by J. Homfray, dated 10 July 1837.

At a distance of a few miles to the south of Singra commence an extensive range of granitic hills which run from the Tikoo Hills parallel with the Amanath, and here bend to the westward, and crossing the Coyle, continue in that direction west. These hills are from 200 to 500 feet in height, and covered with wood; at the base of these hills is a large tract of ground covered with boulders of the same genus; beyond these, to the south, and between it and Palamow, the hills assume the character of very high mountains. The breadth of these two chains is about 10 to 12 miles, and they are intersected by various passes or ghauts fit for the passage of cattle, but none for carriage. It is from this great chain of granitic hills that all the masses of rock found in the Coyle river, and which impede its navigation, take their rise; it will be seen on the Map,* where they are delineated in its course, until we arrive at a small nuddee leading up to Chandoo, half a mile beyond which place the passage is completely blocked up by the immense granitic rocks of all sorts which are there, the river finding its way through the narrow passages, and in gentle falls for the distance of $13\frac{1}{2}$ miles, renders all hope of turning that part of the river to any useful account quite hopeless; whilst on either side the immense rocks which come down and abut close to the river, forbid the making a carriage road, unless at an immense outlay of money, there being only a very short distance which is clear of these impediments. The present communication is by a road through two very steep ghauts from Chandoo to the Daoree Nuddee, which although not of very great height, are difficult to surmount; cattle are unable to carry more than half their usual burthen. Suddenly these rocks terminate and we have a broad river and sandy bottom full 250 yards in width, with sandstone at its edges. At a ford near Mungurdar Nuddee, in the river edge, four or five thin bands of Coal from 4 to 12 inches in thickness, but no thick vein; near to this place is Hotar, and this is conjectured to be the site of Renne's "Coal mine," since there is no other place on the river for some miles where any Coal is found, until we reach the small nuddee

* N.B.—A map was originally furnished with this Report, but subsequently withdrawn.

ABSTRACT of Coal at *Hotar*, in the *Upper Palamow Field*.

Province.	District.	Field.	Locality.	Bed.
Palamow - -	Upper part of the valley.	Palamow village	50 miles from the conflux of the Soane.	3 feet 9 inches.

II. *Singra or Sidra*.

166. On the north-east bank of the Coyle river, at a distance of about 35 miles in a direct line from its confluence with the Soane, Coal occurs in two situations.

Singra.—At this point the Amanath river falls into the Coyle, intersecting several beds of Coal from 1 foot 6 inches to 6 feet in thickness.

That which it was proposed by Major Sage in 1830 to work, is described as a non-bituminous Coal, or anthracite, 4 feet 7 inches thick. Mr. Homfray, who subsequently

NOTES—continued.

nuddee of Burwellia, running to the eastward and at half a mile up that stream there is a fine vein of Coal 3 feet 4 inches thick. This Coal is found also to the westward, at Myapore, and indeed, for an immense distance southward and westward; it is traceable even down to Singboom and towards Ruttenpore; this I learnt from an intelligent native zemindar with whom I was in company for three days, so also to the eastward, and this is what constitutes the Palamow Coal field.

Within the Burrawellia Nuddee this vein of Coal is 3 feet 4 inches, exclusive of some little adhesive black shale, which makes the apparent thickness of the vein to be 4 feet 6 inches. Both sides of this nuddee are very high sandstone hills, and underneath which the Coal is traceable to the eastward and northward, continuing to crop out in a vast number of places, until we bring it fairly over to the Daoree Nuddee, the upper end of which winds into an extraordinary deep and narrow valley within which this vein, as well as another smaller one of 1 foot 6 inches, lying at 6 fathoms beneath it, is found. This valley is generally 10 to 12 yards in width at the very bottom, and sloping rather steep on each side to about 40 or 50 yards in width to the foot of the abrupt precipice of sandstone rock, generally 100 to 150 feet in height, and often much more. This valley is filled with saul trees which are all of small girth, 30 inches to 40, but of immense height, reaching to the level of the top rock, where they become stag-headed and lightning struck; for a distance of three or four miles within this valley the Coal is traceable until in one place, underneath a rock of full 150 feet in height, I found it so firm and promising as to sink and drive in the vein for some yards, raising about 700 maunds of Coal therefrom. There is a shale which overlies the Coal, and between it and the rock roof. The Coal, however, is very dull and sotty, burns with little flame, gives out an intense heat, with very little or scarce any smoke; it retains fire for days together, and to me appears to be a stone coal. There are traces of vegetable impressions upon the top of the coal, but I was unsuccessful in obtaining any kind, either in the sandstone or the shale. The valley abruptly terminates and opens into a woody plain of some miles in extent, in traversing which the shales and the Coal are found all the way round to the foot of the high mountains towards the S. E. in the direction of Tikoo. From the summit of these hills a fine view of the valleys is obtained, and the marked difference in the shapes and appearances of the sandstone formation from that of the surrounding hills of primary origin is finely observable. Ironstone is here found in abundance close to the village of Baumundya, in the Daoree Nuddee, in veins of three and four inches each; these veins are also found in the ravines all the way to Pohea Agar, and at which place there are a number of iron melting furnaces upon the native plan. Iron is here sold generally at 2-12 to 3 rupees per maund of 48 sicca weight seers; it is in lumps of 4 to 5 lbs. each, and has undergone the process of hammering and remelting four times at the time of sale. The ironstone which I found under consumption had been previously roasted and was afterwards put into the little furnace made of clay, and bellows, similar in all respects to that described in the "Gleanings of Science for October 1831." Of the quality of this fine vein of Coal, I shall say little, the quantity of residuum or ashes was small and extremely light, but the difficulty in igniting the Coal is considerable. This Coal, even if worked, would have to be conveyed away on bullocks, as the only practicable present mode, for the reasons before advanced. Here then we have a noble field of Coal, extending five to six miles in breadth towards the south-west and proceeding over an immense extent of country; I know it exists for many miles beyond the Burwellia, and, I think, we may fairly identify it with that found in Singboom from its constant occurrence along the Coyle river in the upper end of that stream. It seems extraordinary that the Damoodah Coal-field should also be traceable all the way up to this same range of hills, passing Ram Ghur and many other places of note, where it is found, and from some samples of Coal from the west of Ram Ghur, I am led to expect, as the Coal approaches those hills, that its quality very much deteriorates. The extraordinary fact of the gigantic reed, whose impressions we constantly discover in the carbonaceous strata, is here found growing in luxuriance. I have brought some whose roots were actually extended four feet into the Coal-bed. This is the only example I know of the living reed being found near to Coal.*

* N.B.—The reed alluded to by Mr. Homfray turned out to be only a grass, *Saccharum spontaneum*, which grows very generally throughout Bengal. No grass or glumaceous plant, we believe, is found in a fossil state in Coal.

Palamow.

subsequently visited the place in 1837, describes the bed as only 3 feet 8 inches thick, and of limited extent and inferior quality.

It is overlaid by several thin beds of sandstone and shale, with one thin bed of Coal 13 inches thick.

167. Mr.

NOTES—continued.

EXTRACT of a Letter from Captain *W. Sage*, dated 27 April 1836.

THE subject of a supply of Coal being one just now of great interest, I purpose giving you a slight sketch of the country abounding in Coal bassets in and about Palamow. I passed into this country in January 1830, crossing the Soane at Bunde Ghât, nearly opposite to Rotas Ghur, and obtaining the left bank of the Coyle or Coel river at Manjian; leaving Guroo I recrossed the Coyle and encamped at Singra, or, as in map, Sidra. The Amanath river joins the Coyle about 100 yards west of Singra. In its course it has cut off a portion of a hillock, $1,200 \times 100 \times 40$, and the following section is observable.

	<i>Ft.</i>	<i>In.</i>
Earth, clay, pebbles, &c. - - - - -	11	6
Shale - - - - -	0	11
Pebbles - - - - -	3	7
Coal, No. 2. - - - - -	1	6
Sandstone conglomerate, increasing in compactness as it descends -	8	0
Non-bituminous Coal, No. 3, or anthracite - - - - -	4	7
	30	1

This Coal rests on a blue sandstone, readily splitting into tables or large flags, depth not ascertained; it is a good useful Coal, burns to a soft white ash, without flame. It was traced nearly three miles up the Amanath. From 1,200 to 1,600 maunds were sent to Dinapore and used in the smitheries, and in brick-burning answered well.

EXTRACT from Mr. *J. Homfray*, Report dated 10 July 1837.

UPON glancing over the map of the Coyle river, which falls into the Soane, and which accompanies this memoir, there will be seen, at a distance of about — miles from the Soane, and on the the right or east bank of the Coyle, a tolerable large river, which falls into it near to the village of Singra.

At the mouth of this river is the Amanath coal-field. Commencing immediately at the junction with the Coyle river we have a sandstone, and at a very short distance up the river are seen on the west bank, first, a vein of coal 3·8, and a little above it, another of about 3 feet, which is, however, divided in its centre by a band of stone of 8 inches, thus dividing it into two veins. This coal is opened to-day for about 600 yards in length, when, from its declining or dipping, it sinks below the river; on the banks of earth also is found another small vein of coal, but which is better seen on the opposite side of the river, where there is a high sandstone rock and the coal vein in full view; it is also seen in several other sites in the river for about one mile distant, where it is terminated by a large basalt dyke, and thus ends the coal on that side or up the Amanath. Near to where this little coal is seen, under the rock there is a small nuddee, which is called Junjunsree, falling into the Amanath, and having its rise, about seven or eight miles distant, under the high hills to the east. Up this little river the upper vein can be traced some distance, but in no place is there more than a few feet of rock over; it is, consequently, soft and tender, and the sandstone rock is scarcely deserving the name of rock, being more a sandy conglomerate. Stretching to the north and east the ground is very full of ravines, and the crop or outburst of this coal is everywhere found, so that, in fact, there appears to be but little covering over it; on the east the traces are cut off by an immense number of small earthy hillocks, among which the sandstone and crop coal is found, and then it seems to terminate, but on the north side it runs rather a greater distance underneath the little village of Bulserah and Seguat, where all traces are lost of Coal. Around this circle of coal is found, and at a distance of two miles on the west and south, and on the direction of the rise of the vein sandstone, and underneath it the usual ironstone measures, in which are two remarkable fine veins of ironstone—the measure is 14 feet in thickness; the upper vein varies from 7 to 12 inches, and and even 14 inches in thickness, and at 4 feet below it is another vein in balls of ironstone, 5 or 6 inches, and in large oval balls, such, exactly, as are common in Europe. Beneath this is a sandstone, and at some distance below it a black aluminous shale, of which the cattle are said to be remarkably fond, and when sick will, of their own accord, go to several well known places, in order to lick it with their tongues. Beneath it is found a sandstone and quartz, and then syenitic quartz, and then the passage is into masses of granite boulders. This ironstone has but a very little covering over it, and it is seen in every little ravine around there, and in the nullahs which fall into the Amanath and Junjunsree rivers, as well as the Doorgatty Nuddee and Soodaban, and down the Coyle River to nearly opposite the village of Rampore and Panjooree. This ironstone is the extreme boundary of this mineral district, the Coal at one corner of it being contained within a very limited circle, the ground being all around here gently undulating, and nowhere having many feet higher than the river bed. Near, however, to the Bulserah village, there is one spot which indicates a little better appearance as to solidity, and should the Coal prove to be really worth pursuing, I should continue to sink a pit, which is already marked out as near to a peepul tree (the only one thereabout); and the reason which would make me believe it to be the most eligible spot is, that the little or upper vein of Coal being thereabout 20 feet below the surface (by calculation), that having all the veins,

one

167. Mr. W. B. Tytler, Civil Engineer employed in steam department, having visited Palamow in 1839, reported the existence of a 6-feet bed of Coal a little above the village of Mirall, near Singra, and states the extent of the Coal-beds there to be quite inexhaustible. (See Proceedings 5th August 1839, paragraph 7.)

ABSTRACT of Coal near the village of Singra.

Province.	District.	Field.	Locality.	Beds.
Palamow - -	Middle district -	Singra or Sidra -	Singra village - { Above Miral vil- lage - - -	a, 13 inches. b, 4 feet 7 inches. 6 feet.

III. Gorossan

NOTES—continued.

one over the other, the bottom or main Coal might probably be there found more solid than what it has proved at Singra, or at the opening higher up the river. The field would, however, be very limited, as the great number of ravines materially decreases the quality of surface, and probably 200 to 300 biggahs would be the extent, there being two dykes perceptible to the eye, which somewhat tends to increase my hope of its extent being greater than what is stated. These ravines are more numerous on the south side towards Miral, but the ground towards Seguat has the appearance of being tolerably even and undisturbed. I have alluded to the quality of the coal hitherto obtained as very inferior; in fact, it scarcely appears to have been consolidated, and there is in this formation of sandstone and Coal something so very unusual, that I must dilate on it, to show that the nature of the Coal is imperfect, and that we can scarcely hope to obtain anything better from a formation which, to me, appears to be so recent and imperfect. Should, however, contrary to my expectation, the Coal prove chemically of value, it may then be worth while to continue the sinking of that pit marked out near to the peepul tree, but otherwise I should scarcely think it worthy of pursuit.

The order of the Strata is thus:

	Surface.	Ft. in.	
Sandstone - - - -	- - - -	20 0	This is merely a conglomerate, having large pebbles therein, particularly at the bottom.
Coal - - - -	- - - -	1 4	
Shale - - - -	- - - -	0 10	
Sandstone - - - -	- - - -	18 0	This is very soft, and full of pebbles.
		Ft. in.	
Coal - - - -	- - - -	0 10	3 2 Very streaky Coal.
Stone - - - -	- - - -	0 8	
Coal - - - -	- - - -	1 8	
		Ft. in.	
Shale - - - -	- - - -	30 0	This sandstone is remarkable for the number and size of pebbles, increasing in size downwards, until they actually occur in contact with the Coal, and that, too, when there is one vein of Coal superimposed over the other. I know of no other instance of such a conglomerate; the pebbles on the Coal are, some of them, 1 lb. to 2 lbs. weight, and those in the upper sandstones appear to be of the same genus, although they must have been so fixed at different ages.
Sandstone - - - -	- - - -	8 0	
Coal - - - -	- - - -	3 8	
Shale - - - -	- - - -	3 0	
Sandstone, assumed measures - - - -	- - - -	60 0	
		Ft. in.	
Sandstone measures {	Shale -	5 0	14 0
	Ironstone -	1 0	
	Shale -	4 0	
	Ironstone -	0 6	
	Shale -	3 6	
Sandstone - - - -	- - - -	12 0	
Aluminous schist - - - -	- - - -	3 0	
Sandstone - - - -	- - - -	12 0	
Quartz, and beneath it granite.			

Now, this extraordinary occurrence of pebbles in a series of rocks lying one over the other, with intervening veins of Coal, is something to me new. Of single conglomerates there are many instances, but here the pebbles seem to have subsided through the sandstone, when it must have been in a semi-fluid state, as it will be seen by the specimens that the largest pebbles are at the lowest part of the sandstone, and that they gradually decrease in size upwards, until the upper portion of the measure is but a coarse gritty sandstone. From this very extraordinary circumstance, I infer that we cannot hope for any very solid ground hereabouts, and without it I fear that any mining operation would be very hazardous; and from the want of solidity in the rock, would be attended with constant danger to the colliers. Should, however, these objections prove futile, the situation being within half a mile of an excellent ghaut, where the coal could be laden on to small boats proceeding down the Coyle river to the Soane, would be extremely favourable.

Palamow.

III. *Gorossan Nulla.*

168. On the Gorossan Nulla (which we cannot find laid down on maps to which we have access), Major Sage, in 1830, discovered a highly bituminous Coal, of very superior quality. The locality at which the Coal occurs is not described. Two beds are intersected at the same spot, which is stated to be about five miles beyond Chapari. The uppermost bed is only 13 inches thick, the lower one, which is separated from it by one foot of shale and one foot four inches of sandstone, is three feet nine inches thick, and said to burn with a cheerful blaze in an open grate.

ABSTRACT of Coal on the *Gorossan Nulla.*

Province.	District.	Field.	Locality.	Beds.
Palamow - - - - -	- - - - -	Gorossan Nulla	Five miles beyond the village of Chapari	a. 13 inches. b. 3 feet 9 inches.

IV. *Rajhara.*

169. Mr. W. B. Tytler reported, in a letter dated 22 September 1839, the discovery of a distinct Coal basin, near the village of Rajhara, 10 miles north of Singra, and consequently within 25 miles, in a direct line, of the Soane river. He was led to this discovery by the numerous fragments of Coal he found in the Ladabah Nullah. He traced these fragments for about eight miles from the confluence of this nullah with the Coyle, when he came upon a vein nine inches thick.

Since then Mr. C. B. Taylor, an agent of Messrs. Carr, Tagore, & Co., or the Bengal Coal Company, has established a mine at this point.

We have understood Mr. Taylor to state the bed of Coal here opened to be six feet.

ABSTRACT

NOTES—continued.

EXTRACT of PROCEEDINGS of the Coal Committee, dated 5 August 1839, paragraph 7.

RECEIVED a Report of Mr. Tytler, announcing the discovery of a bed of Coal on the Amanath, near the village of Miral, and close to Singra, the place visited in 1836 by Mr. Homfray. The bed is said to be of good quality, and inexhaustible, 6 feet 2 inches in thickness. The specimen forwarded to the committee appeared to be a dull slaty coal.

EXTRACT of a Letter from Captain *W. Sage*, dated 27th April 1836.

I passed through Shapur, Chainpur, Chandas, and Chapari, above five miles beyond which I found Coal beds on the Gorossan Nullah, or river, entirely different from those of Singra. The Coal is very bituminous, burns with a clear bright flame, and makes a cheerful fire in an open fire-grate.

Section of the bank of the Gorossan river:

	<i>Ft. in.</i>		<i>Ft. in.</i>
Earth, sand, and gravel -	- 8 0	Shale - - - -	- 1 0
Sandstone - - - -	- 6 4	Sandstone - - -	- 1 4
Shale (bituminous) -	- 1 0	Coal, No. 2 - - -	- 3 9
Sandstone - - - -	- 2 1		
Coal, No. 1 - - - -	- 1 1	Total - - - -	- 24 7

EXTRACT of a Letter from Mr. *W. B. Tytler*, Steam Department, to Captain *J. H. Johnston*, dated 22 September 1839.

I beg to report a new Coal basin, which I discovered while passing through the jungles between Seeckie and Singrah, on the 6th instant. This field is near a village called Rajbarah, about 10 miles due north from Singrah, on the Ladabah Nullah. I traced this field of Coal by the fragments of Coal I found on the sands of this nullah, which I explored eight miles from the banks of the Coyle, where the basin is situated. The vein of Coal is only nine inches thick, and quite in the bed of the nullah, the banks of which are thickly covered with jungle. The quality of the Coal is about equal to that of Upper Miral, which it resembles more than any other Coal I have seen in this country.

Palamow.

ABSTRACT of Coal in the *Rajhara*.

Province.	District.	Field.	Locality.	Beds.
Palamow - -	Lower portion of the valley.	Ladabah River -	Rajhara - -	{ a. 9 inches. b. 6 feet.

CENTRAL COAL DISTRICTS.

Central
Coal Districts.

170. So called in this report from their being situated beyond the influence of navigable rivers and coasts.

They are as follows :—

I. Ramgurh.
II. Chotessgurh.
III. Singrowli.

IV. Surgooja.
V. Sohagpore.

Although situated beyond reach of the great lines of navigation, the resources of these districts are calculated to effect improvements of the most important nature when properly directed.

The facilities they will afford, in the first instance, in furnishing all the material that can be requisite in the construction of roads, must go far in determining the scale and the direction of such works throughout the tracks in which such valuable resources occur.

The two first, it will be observed, extend in a direct line between Calcutta and Bombay, presenting abundant supplies of Coal and of iron materials along the line for a distance of 360 miles. The third and fourth fall equally within the direct line from Calcutta to Mirzapore, and with the fifth into that between Mirzapore and the Nerbudda. The greater portion of three most important lines would thus be supplied with all the requisite materials, on the spot, for the construction of the most improved roads. The Coal these central districts afford has, in most instances, been found of a very superior description.

These districts being more or less elevated, their climate is consequently exempt from many of the objections to the plains; and the manufacture of iron on a small scale by the people indicates a disposition on their part for manufacturing pursuits.

I. *Ramgurh*.

171. *Bullea*.—About 30 miles west of the Coal districts of Burdwan and Adjii, and 14 miles south of Hazareebaugh, Coal occurs about a mile or so from the village of Bullea, on the banks of the Sancheraie, a tributary of the Haharoo Nulla. The bed is stated to be three feet in thickness, and of considerable extent.

Badam.—Again, about 30 miles to the left of the trunk-road from Calcutta to Benares, at a place called Badam, extensive beds of Coal have recently been discovered by persons employed in making a road from Chota Nagpore and Hazareebaugh. The Coal resembles that of Burdwan; the road crosses over the beds.

Central
Coal Districts.

About half a mile to the east of these last, beds of Coal were observed, of very promising quality and great extent. The following are the results of analyses of three samples from these beds, recently received from Lieutenant Colonel Ouseley :

No. 1.	Sp. Gr.	- - -	1.31	No. 2.	Sp. Gr.	- - -	1.19	No. 3.	Sp. Gr.	- - -	1.29
	Carbon	- - -	61		Carbon	- - -	53		Carbon	- - -	60
	Inflammable matter	- - -	27		Inflammable matter	- - -	31		Inflammable matter	- - -	32
	Ash	- - -	12		Ash	- - -	16		Ash	- - -	8
in - - - 100 parts.				in - - - 100 parts.				in - - - 100 parts.			

172. At Angballa, about 43 miles east of Hazareebaugh, close to the 187th mile-stone, on the new Benares road, a bed of Coal occurs in a nullah on the right side of the road proceeding from Calcutta. The bed is said to be large.

ABSTRACT of Coal in the *Ramgurh* District.

District.	Field.	Locality.	Beds.
Ramgurh -	Bullea - -	{ In the Sancheraie, a tributary of the } Haharoo - - - - -	3 feet.
	Badam - -	{ Within 30 miles of the Benares } road - - - - -	Several large beds.
	Angballa - -	{ On the right-hand side of the new } road from Calcutta to Benares, } near the 187th mile-stone - - -	Size not stated.

II. *Chotessgurgh*,

NOTES.

EXTRACT of a LETTER from Mr. Assistant Surgeon *William Dunbar*, dated 23 February 1841.

ON the banks of the Sancheraie, a small nullah running into the Haharoo, I first saw the Coal, in a bed about three feet in thickness, with a gentle dip or inclination to the west. It was splintery, very black, lying below a friable sandstone and alluvium containing kunkur. The bed seemed to be of great extent, and I have no doubt that any quantity of Coal can be procured at this place.

At Bullea there are large and very extensive ironworks, employing a great many persons; and yet, strange to say, though most of the inhabitants are aware of the existence of this extensive Coal-bed, they never use it for their furnaces, but are at great expense in transporting wood and charcoal from the forests, several miles distant. I endeavoured to impress upon some of the workmen how advantageous it would be, and what a saving would accrue to them, were they to use this Coal; but by their answers they evinced their utter indifference to the subject, and their determination to adhere to the customs of their fathers. The Coal-bed is not above a mile distant from the works.

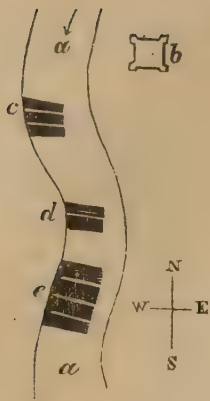
EXTRACT of a LETTER from Lieutenant Colonel *J. R. Ouseley*, dated 16 August 1841.

COAL is well known to be abundant in Pachete, and some seven or eight years ago it was discovered, on the old road from Hazareebaugh to this, by Lieutenant Richard Ouseley, the Assistant to the Commissioner: it was somewhere near Bullea, one march from Hazareebaugh. I am happy to say I have, in making the new road, found an immense field of Coal, about nine or ten miles south of Hazareebaugh, of which I shall do myself the honour of sending a specimen. The best is in a nullah a mile off the road; it nearly equals some anthracite Coal I discovered in the Hoshungabad district some years ago, which was declared by the Bombay Committee to be better than any other Coal, Scotch or English (I believe 84 per cent.); I sent down 200 bullock-loads, and it was tried on board a steamer. This Coal would I think prove, on digging a little deeper, to be just the same; there would be no greater difficulty in removing it than from Palamow, where there is a great quantity of Coal of the Pachete kind.

EXTRACT of a LETTER from Colonel *Ouseley*, to *F. J. Halliday*, Esq.; dated Chota Nagpore, 31 December 1845.

WHEN I made the road between this and Hazareebaugh, at a place called "Badam," they had to cut along the southern slope of an ascent rather deeply, when a large field of Coal was found; this was of the same description as that called Burdwan Coal; but to the east of it about a mile, I found on examination some beautiful Coal, of which I send a specimen. It is only second to that I discovered at Bénar, in Hoshungabad, in 1834-35. Coal of this kind will do more than double what the Burdwan (Pachete) Coal does, has little ash, and I think would not leave much scoria on the bars of the furnace. In a few days I purpose proceeding again to the place. I have no doubt that this Coal will coke as well as that of Bénar, a desideratum of much importance, as Indian Coal has not been found to coke (so says Dr. McClelland), with the exception of that at "Bénar."

The

II. *Chotessgurh, Berar Rajah's Country.*

173. On the Hutsoo* river, a large branch of the Mahanuddy, great beds of Coal occur a little to the south of the fort of Koorba. The bed of the river, for a distance of 716 yards, appears to be composed of alternate beds of white sandstone, slate-clay, and Coal. These rocks dip from 1 to $3\frac{1}{2}$ inches in the foot. The annexed sketch exhibits the relative position of this Coal to the fort: *a. a.* the bed of the Hutsoo river, about 300 yards broad; *b.* the fort; *c.* bed of coal intersecting the river in the direction of W.N.W., dipping N.N.E. 1 inch in 12, and presenting an outcrop of probably about 100 yards; *d.* a bed called coal-clay, as marked on Colonel Ouseley's sketch; *e.* a bed of Coal dipping 1 inch in 14, and apparently, from the sketch of Colonel Ouseley, 200 yards in thickness.

The quality of this Coal is stated to be very superior, although not yet established on analysis.

Although this Coal is situated at a distance of 320 miles inland from Point Palmyras, yet the Mahanuddy is easily navigable to Sumbulpore, within 100 miles of the Coal; it deserves to be considered, therefore, how far the superior quality of this Coal might render the Koorba beds worthy of attention for the supply of the coast.

ABSTRACT of Coal at *Chotessgurh*.

Province.	District.	Field.	Locality.	Beds.
Chotessgurh	Ruttenpore	Hutsoo River	{Near the Fort} of Koorba }	<i>a.</i> — ? <i>b.</i> 200 yards.

III. *Singrowli.*

NOTES—continued.

The Coal I now send is superficial. On cutting deeper into the mass, which is not in thin strata, as is usually the case, but of vast thickness, I am convinced it will prove as good as any Welsh or English Coal. It is also as well that I should mention that iron is now made close to where this Coal is, but with charcoal.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 16 August 1841.

I found Coal also in the Husdah River at Koorba, near Ruttunpore (in Chotessgurh), of a very valuable kind, and laid open by the river for a vast extent.

EXTRACT of a LETTER from the same, to the same, dated 27 April 1845.

The Koorba Coal could be sent down the "Husdah" to the Mahanuddy in the rains, and a collection made of it at Sumbulpore, whence the boats could reascend as often as the weather would permit.

At Chichowlie on the Husdah, where there is a small fall of 20 feet over black marble, it may, perhaps, be necessary to have another Coal depôt here, the boats from Koorba to Chichowlie unloading and returning to Koorba—the Sumbulpore boats loading at Chichowlie, for there are no further obstructions to the navigation. All this part of the country I have personally examined.

I have sent for some of the Koorba Coal, which you shall have as soon as it arrives. This Coal is nearly as good as that of Bénar, and the field appears to equal it in size. I give a separate sketch of the locality in which I found it on the 14th March 1840.

* Or more strictly Husdah; but Hutsoo is the name given on Arrowsmith's map.

III. *Singrowli.*

174. On the tablelands at the head of the Soane, 50 miles to the westward of Palamow, Coal has been found in several situations.

Kotah.—On the Bulloa Nuddee, a mile N.N.W. of the village of Kotah, four thin seams of Surface Coal have been found, varying in thickness from 6 inches to 14 inches.

The beds are supposed by Captain Wroughton (to whom we are indebted for what we know regarding them) to extend towards Burdee, in the same district.

175. At a place called Lewallah Mookhe, eight miles S.W. from Kotah, and seven miles W. from the town of Sipore, in the territory of the Rewah Raja, a bed of Coal one foot thick occurs.

ABSTRACT of Coal in *Singrowli.*

District.	Field.	Locality.	Bed.
Singrowli -	Kotah - -	Mowzah - - -	6 inches
	Sukhwon - -	Lewallah Mookhe - -	1 foot 2 inches 1 foot.

IV. *Surgooja.*

176. On the western side of a high tableland called Maynpat, situated between the tributaries of the Hustoo and the Soane, Coal of superior quality occurs in several situations.

The first is in the bed of the Rehar River, a tributary of the Soane, about seven miles east from Burra, on the road to Dondra. The extent of the Coal is not particularly described, Colonel Ouseley merely remarking that it is of very fine quality, like that of Koorba, and in great quantity.

At Manpore, about 14 miles west by north of Burra, and about eight or ten miles west of the celebrated hill-temple of Ramgurh, a bed of superior Coal occurs. The situation is further defined as 16 miles south of Cherghur.

ABSTRACT of Coal in *Surgooja.*

Province.	Field.	Locality.	Bed.
Surgooja - -	Manpore - -	16 miles south of Cherghur	3 feet
	Rehar River - -	7 miles east of Burra -	Many yards thick

V. *Sohagapore.*

NOTES—continued.

Referring to Arrowsmith's map, the Singrowlie Coal at Kotah would seem to be situated as near to Chunar as the Palamow Coal is to the Soane, or Burdwan to the Hooghly.

Captain Wroughton, adverting to this subject in a letter to the Revenue Board, 30th April 1840, remarks:—"Many reasons induce me to believe that I can pursue the Kotah strata to some situation adjacent to the Goput River, which forms a conflux with the Soane at the town of Burdee, from whence the Coal could be conveniently and cheaply conveyed, by a road uniting with the Mirzapore and Jubulpore Road."

The following indications of the existence of Coal in the direction of Burdee are stated—the first on the authority of Captain Wroughton, the others on that of Captain Waugh. It is not, however, to be understood that the *carboniferous* beds alluded to are Coal, but something, in the opinion of Captains Wroughton and Waugh, usually connected with it:—

1. In the Demarh Nullah, which flows into the Goput at a point S. 25 W. 27 miles from the town of Burdee, situated at the conflux of the Soane and Goput Rivers, *carboniferous* beds are found.

2. Again, in the Goput River, at the village of Summurd, a distance of 37 miles S. 25 W. from Burdee, *carboniferous* beds occur.

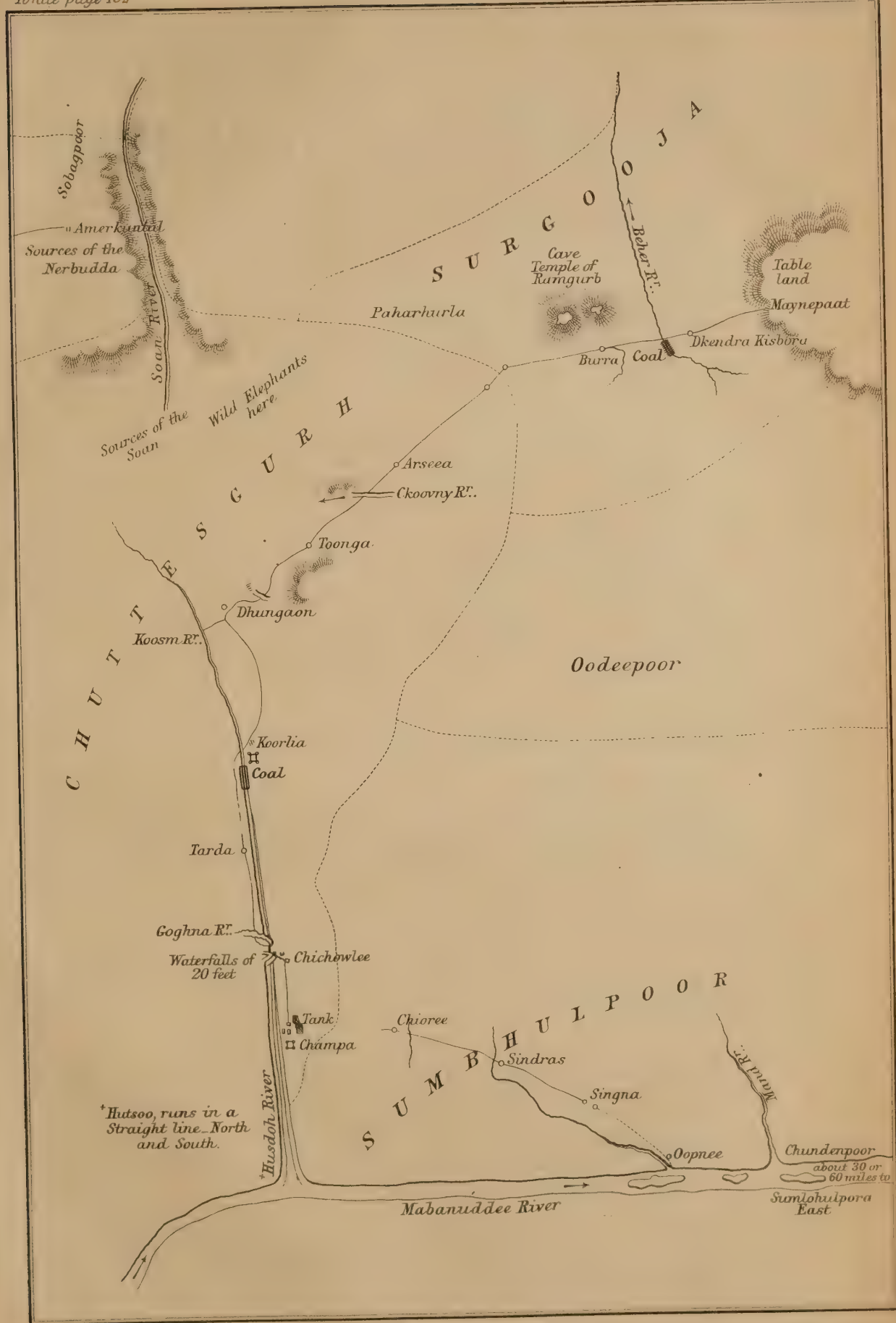
3. Again, at two places about $4\frac{1}{2}$ miles S. 25 W. from the last-named.

4. Again at Neoru, S. 13 miles from Sammurd, *carboniferous* beds are found.

5. At a place called Pipperah, 60 S.W. $14\frac{1}{2}$ miles from the Grand Trigonometrical Station Moreagurh, similar beds occur.

6. Again at Koraree, in the Kanuk Nuddee, $4\frac{1}{2}$ miles south of the preceding, *carboniferous* beds were observed by Captain Waugh on the route from Amerkuntuk to Chunar, *via* Burdee.

N. B.—From the conflux of the Goput and Soane at Burdee town, this last point bears S. 21 W., distance 68 miles to Moreagurh Grand Trigonometrical Station.



V. *Sohagepore.*

177. In the same parallel of latitude with Singrowlie, and intermediate between that district and Jubbulpore, Coal has been found of excellent quality in several places, indicating so many great Coal districts.

A few miles north-west of Sahagepore, and at an equal distance from the Soane, Coal is reported on the authority of the late Major Franklin to exist, but there would appear to be some doubt as to the precise locality; and again it is said to occur three miles south-east of Sohagepoor, at the junction of the Tipah with the Soane, but this locality is also doubtful.

178. *Keyverji River.*—About two miles from the junction of the Keyverji river with the Soane, and one mile from the village of Seetamadhi, the Keyverji river intersects a bed of soft black shale, at a distance of 20 yards from the east bank; in this situation Coal occurs, but to what extent is not stated.

179. *Johilla River.*—On the banks of the Johilla, a feeder of the Soane, near a place one mile south-west from Palee, Coal occurs. The two last localities have been communicated to the Committee by Dr. Spilsbury, on native testimony.

Cheirdiah.—Coal is said to occur in the Rewah territory near Cheirdiah, but on what authority does not appear.

ABSTRACT OF COAL in the Sohagepore and Nagpore Districts.

Province.	District.	Field.	Locality.	Beds.
Central Province	Nagpore -	Soane - -	{ North-west ; Sohagepoor { South-east ; Sohagepoor -	Not stated. Not stated.
	Sahagepore -	{ Keyverji - { Johilla -	Near Seetamadhi - - Near Palee - " -	Not stated. Not stated.
	Rewah -	- - -	Near Cheirdiah.	—

NOTES—continued.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 16 August 1841.

In the Rehar river, I found also great quantities close below the table land of the Mynpat, Surgooja.

Coal is applied to no use whatever by the natives. Indeed it was very singular to find that they were in every instance where newly discovered, ignorant of its being combustible; accident, one would have supposed, might have given them that knowledge. I shall send for specimens of all the Coal I know of as being distinct beds or fields, and of the iron ore, and forward them to you.

EXTRACT of a LETTER from Lieutenant Colonel *Ouseley* to the Secretary of the Coal Committee, dated 27 April 1845.

THE Koorba Coal is much the same as that at Benar. So is the Coal of the Rehar river.

— Between Burra and Dondra Kishora in the Surgooja Province, west of the Maynpat, in the Rehar river, which falls into the Soane, there is very fine Coal like that at Koorba, and easily got at.

1. In the pergunnah of Dhungewan, district of Sohagepore, at a point two miles east by south from the village of Pusan in the Keyverji Nuddee which falls into the Soane at a point $5\frac{1}{2}$ miles north-east from the chief village of Dhungewan, an outcrop of surface Coal is found of about one foot thick.

2. Johilla Nuddee, at a point $6\frac{1}{2}$ miles south-east from Singurrah, Coal occurs with shale and a species of iron clay, about 20 feet down the bank; thickness of the Coal, one foot.

The above is stated on the authority of Captain Wroughton. The following on that of Dr. Spilsbury, in a letter addressed to the Secretary of the Coal Committee, under date 2d October 1840.

The Keyverji and other specimens and papers relate to the sites of Coal, not very promising certainly, but without visiting the spots it is difficult to say what promise would be afforded of better; but still it shows what an extensive Coal field there is at a greater or less depth. In the Johilla, a feeder of the Soane river, near Palee, we met with traces, as the specimens collected on a trip to Umurkantuk (which I am now sending down) will show; and again near Cheirdiah in the Rewah territory.

NERBUDDA.

Nerbudda.

180. THE Nerbudda valley promises to be the nearest, if not the only direct source from whence supplies of Coal are to be furnished to Bombay, from the continent of India.

Our limited knowledge of the Nerbudda, and the objections to the climate, whether well or ill-founded, are obstacles that may retard, for a time, the necessary improvements required to render the Coal available.

181. There are difficulties, however, which from the necessity of overcoming them, seem to have been only intended as proper incentives to human enterprise. Of these, perhaps the obstruction to the navigation of the Nerbudda is one, particularly as the Coal of the Nerbudda valley is situated more conveniently with regard to Bombay, than that of Pennsylvania, to New York and Philadelphia.

In the case of the Nerbudda, the difficulty would consist in evading the impracticability of the river by means of a railroad for a distance of 60 to 90 miles between Tullockwarra and Chiculda, which, so far as we can glean from all official reports that have been made on the subject, would give 290 miles of improveable river.

The Nerbudda Coal is 350 miles distant from Bombay, while that of Carbondale in Pennsylvania, is 250 miles distant from Philadelphia and New York; but in the former case we should only have a difference of level of about two feet per mile to overcome, while in the latter the Americans had an average of 9 feet 7 inches per mile throughout to encounter.*

182. The greater part of the Coal in use at Bombay is, we presume, at present the produce of English mines; and we know the Peninsular and Oriental Company depend chiefly on English Coal for the supply of their large steamers between Calcutta and Suez. But whatever the resources of Great Britain may be in a mineral so essential to her own domestic improvement, they should not be unnecessarily drained for the navigation of the eastern seas.

This reason alone might be sufficient to warrant such arrangements as would render the abundant repositories of superior Coal in India available for the gradually increasing public wants.

183. Coal occurs extensively, and of very superior quality, in three different districts in the valley of the Nerbudda.

I. Gurrawarra district, on the Seeta Rewah or Sakar river, which falls into the Nerbudda about 70 miles above Hoosingabad.

II. In the Baitool district, intersected by the Towah river, which falls from the south into the Nerbudda at Hoosingabad.

III. At the head of the valley on the banks of the Nerbudda itself, near Jubbulpore.

I. *Gurrawarra.*

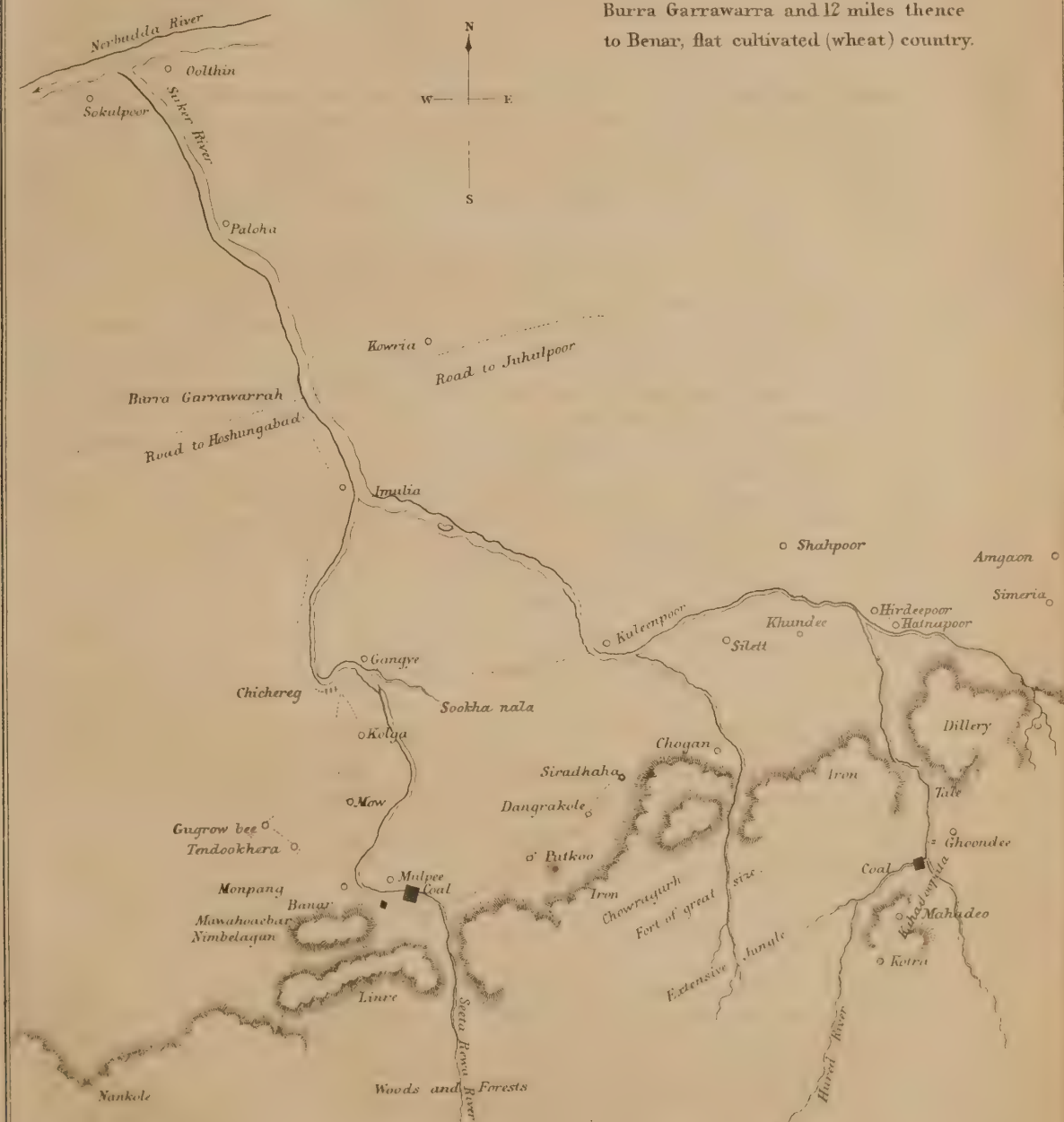
184. The most important Coal beds in the Nerbudda valley are situated in the Gurrawarra district, 70 miles above Hosungabad. Indeed they would appear from the notes of Colonel Ouseley, to be the most important in India, not merely from their extent, but also on account of the superior quality of the Coal. They occur at Benar on the Seeta Rewa river, a branch of the Sukur, which falls into the Nerbudda river in the Gurrawarra district from the Mahadeo Hills, on the south side of the valley.—(See sketch.)

185. The Benar Coal is exposed on both banks of the Seeta Rewa river, at a point where that stream issues from the Mahadeo Hills. The Seeta Rewah flows from

* N.B.—A Report on this subject will be found in the records of the late Coal Committee, some time since deposited in the Asiatic Society.

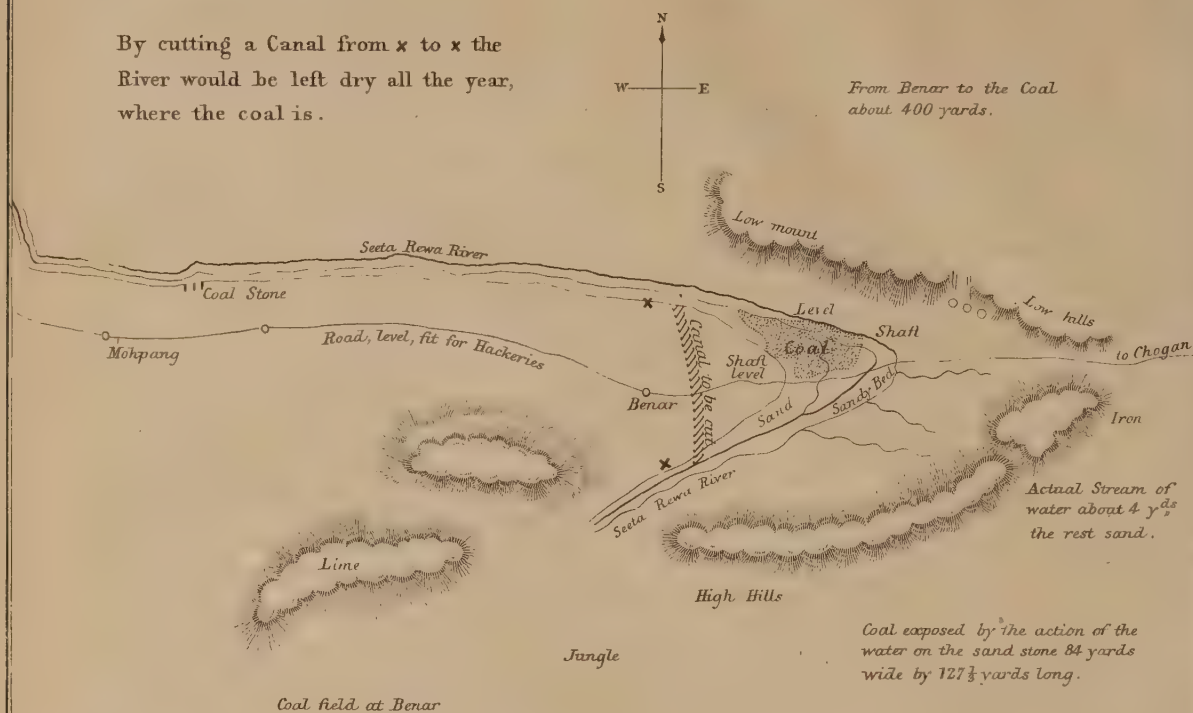
SKETCH OF THE COUNTRY NEAR THE BENAR COAL FIELD.

About 12 miles to the Nerbudda from
Burra Garrawarra and 12 miles thence
to Benar, flat cultivated (wheat) country.



SKETCH N^o 1.

By cutting a Canal from x to x the River would be left dry all the year, where the coal is.

SKETCH N^o 2.SKETCH N^o 3.

from thence through a rich cultivated plain, a distance of 12 miles to the town of Gurrawarra, where it joins the Sukur which falls into the Nerbudda, after a continued course of 12 miles more, through the same rich flat country. The whole distance from the Nerbudda to the Coal mines at Benar, being 24 miles, with a cart road the whole way.

It would appear from the annexed notes of Lieutenant Colonel Ouseley that there are three beds of Coal in this locality of 20 feet, 40 feet, and 25½ feet in thickness, respectively, covered merely with—

- 1st. Sandstone, 5 to 6 feet.
- 2d. Good Coal, 3 feet.
- 3d. Quartz sandstone, 1 foot, after which come the three successive beds of Coal of the dimensions above stated.

186. *Kotra*.—On the Hard river, one of the tributaries of the Sukur, 20 miles to the eastward of Benar, three beds of Coal were found by Colonel Ouseley, the largest of which is 4 feet in thickness. These beds are situated near the confluence of the Hard with the Sukur.

ABSTRACT of COAL at Gurrawarra.

District.	Field.	Locality.	Bed.
Gurrawarra	Seeta Rewa River	Benar	a, 20 feet. b, 40 feet. c, 25½ feet.
	Kotra	Junction of the Hard with the Sukur Rivers	a, 1 foot. b, 2 feet. c, 4 feet.

II. Baitool District.

187. Baitool Coal district is situated at a distance of 30 to 40 miles from the Nerbudda river at Hoosingabad. The intermediate country is rough and hilly, without water carriage. But the beds of Coal are numerous, large, near the surface; and the mineral itself of superior quality.

188. *Towah*

NOTES.

By Lieutenant Colonel Ouseley.—Benar, discovered 4th January 1845, centre of the bed examined, as far as 40 feet thick, right bank 20 feet thick, left bank 25½ feet thick.

Benar Coal exposed by action of the water, 84 yards wide, and 127 yards 12 inches long in the river.

Sandstone	-	-	-	-	-	-	-	-	5 to 6 feet.
Good Coal	-	-	-	-	-	-	-	-	3 feet.
Quartz Sandstone	-	-	-	-	-	-	-	-	1 foot.

Thirty or 40 feet in the centre bed of the Coal 83 per cent. better than the Scotch Coal tried on the "Indus" Steamer at Bombay.

Reported by Colonel Wood, Secretary, Bombay Government, 29th June 1839.—I could not ascertain how thick the lowest bed of Coal was, more than 40 feet.—(See sketch, No. 1.)

By excavating, no doubt the 24 miles from the Coal to the Nerbudda would admit of conveying the Coal by water. But it is to the railway I look for the removal of the Coal; for the Bombay and Calcutta line should actually commence here, where the iron is produced (this is the only Coal that cokes in the way the Welsh Coal does, in long heaps); and along the base of these hills the railroad should run; they are a continuation of the "Mahadeo" Hills or "Sissinchul," and extend away west, under different names, to Asseergurh. In Rajaborang and the Relybest Hill, Coal is found, pieces having been brought in to me; but I never visited the locality. Ever since 1836 I have thought it advisable that this Coal should be first applied to smelting the ore (iron) making it into rails, and laying them from the mines towards Bombay and Calcutta at the same time.—(See sketch, No. 2.)

The annexed sketch shows the relative position of the localities of Coal in the Baitool district, on the authority of Colonel Ouseley.—(See sketch, No. 3.)

Nerbudda.

188. *Towah River*.—At a place called Mardanpore, on the Towah river, four miles east of Shawpore, and at a distance of 40 miles from the Nerbudda river, a little above Hoosingabad, a six-feet bed of Coal has been found by Colonel Ouseley.

189. *Boragurh*.—At Boragurh, near Mardanpore, two small beds of Coal were found by Colonel Ouseley, one of them 21 inches and the other 12 inches thick.

190. *Sonadeh*.—Eight miles south of Bhoorda, on the Bhoorna river (one of the tributaries of the Towah), Coal occurs on both banks; neither the number, size, nor other peculiarities of the beds at this locality being mentioned.

ABSTRACT of COAL in the Baitool District.

District.	Field.	Locality.	Beds.
Baitool - - -	{ Shawpore - -	{ Mardanpore - - -	6 feet.
		{ Boragurh - - -	{ 1 foot 9 inches.
		{ Bhoorna River -	{ 1 foot.
		Eight miles south of Bhoorda.	Size not stated; from 9 inches to 2 feet thick.

III. *Jubbulpore District.*

191. Coal occurs at the head of the valley, on the banks of the Nerbudda itself, of a very superior quality, and in extensive beds, as far as they are known.

192. *Lemata Ghat*.—About nine miles from Jubbulpore, a very large bed of Coal, many yards in thickness, crosses the bed of the Soane obliquely near Lemata Ghat. This Coal is of first-rate quality. (See 77 in the Analyses of Indian Coals.) It is quarried in small quantity by the European residents at Jubbulpore from the bed of the river, where it is left dry after the rains.

193. A second bed occurs 400 yards lower down the stream, also of large size, but the quality of the Coal is said to be soft.

194. In the station of Jubbulpore, Coal has also been found at a depth of 70 feet, thus proving the existence of extensive Coal formation in this vicinity.*

ABSTRACT of COAL at Jubbulpore.

District.	Field.	Locality.	Beds.
Nerbudda - -	Jubbulpore - -	{ Lemata Ghat - - -	12 feet.
		{ 400 yards lower down the river - - -	6 feet.
		{ Cantonments at a depth of 70 feet - - -	Not traced.

NOTES—continued.

NOTE by Colonel Ouseley.—Sonadeh Slope, down towards the north, 6, 7, 8, or 9 feet sandstone.
1 foot 9 inches Coal - - - - - 1
9 inches sandstone.
9 inches Coal - - - - - 2
3 feet sandstone.
1 foot Coal - - - - - 3
2 feet sandstone.
10 or 12 inches Coal - - - - - 4
Two miles west of Sonadeh more Coal is found.

* Lieutenant Colonel Cox, 58th Native Infantry, forwarded to the Agri-Horticultural Society specimens of a superior Coal, said to be from the Nerbudda, and which nearly corresponds in composition with Scotch Cannel Coal. (See 100 in the Analyses of Indian Coals.)

C U T C H.

195. Forty miles from the northern coast of Cutch two thin seams of Coal have been observed, varying from 1 inch to 20 inches in thickness. They are exposed by the bed of a river near Bhooj, between Seesugud and Koohee, at a place called Trumboo, and also at Doojapore.

Cutch.
—

196. No expense has been spared to follow up these indications, but without success; a depth of 190 feet was penetrated, chiefly through thin bedded sandstone of various colours, its texture changing to coarse and fine argillaceous, siliceous, and ferruginous, friable and hard, together with numerous layers of clay and pyritous iron ores, with a few layers of slate clay; and finally, at a depth of 190 feet, extremely fine particles of quartz, with an artesian spring of water, were reached.

ABSTRACT of COAL at Cutch.

District.	Field.	Locality.	Bed.
Cutch - - -	Near Bhooj - -	{ Doorjapore - - - - - In the bed of the Trumboo } River - - - - - }	20 inches. Several thin seams.

TABLE of INDIAN COALS analysed in the Laboratory of the Honourable Company's Dispensary, from January 1839 to April 1846, in continuation of Prinsep's Table, "Journal Asiatic Society," 1838, p. 177.

No.	LOCALITY.	QUALITY.	Specific Gravity.	Composition in 100 parts.			From whom received.
				Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	
60	Moulmein - - -	Cannel Coal - - -	1·177	42·8	54·6	2·6	Mr. Blundell, 7th May 1839.
61	Hoong, south of Ramree, six miles.	Caking Coal - - -	1·32	36·	49·	15·	Capt. Bogle, 1st June 1839.
62	Tyroo Ghat, Assam - -	Ditto - - -	1·3	40·	55·	5·	Capt. Jenkins, 3d August 1839.
63	Palamow Mirall - - -	Slate Coal - - -	1·26	44·	50·	6·	Mr. Tytler, Steam Department.
64	Palamow - - -	Slaty Crop Coal - - -	1·48	32·	58·	10·	Ditto, specimen marked "Palamow."
65	Palamow, "Singra" - -	Ditto - ditto - - -	1·2	25·	63·*	12·	Ditto - ditto, 10th September 1839.
66	Mergue - - -	Caking Coal, excellent -	1·27	55·	40·	5·	Mr. Blundell's assistant, Lieutenant Hutchinson, 27th August 1839.
67	Byrung Ponjie Sylhet -	Ditto - - ditto - -	1·3	34·	64·5	1·5	Major Lister, 4th September 1839.
68	Ditto, variety - - -	Slaty, inferior - - -	1·4	25·	29·	46·	Ditto - - - ditto.
69	Ditto - ditto - - -	Surface Coal - - -	-	30·	50·	20·	Ditto - - - ditto.
70	Ditto, a different sample -	Caking Coal - - -	1·3	51·	42·	7·	Ditto - - 2d January 1840.
71	Chuppra, on the Soan -	Slate Coal, mixed - -	1·5	32·	57·5	10·5	Mr. Ravenshaw, January 1840.
72	Borneo - - -	Ditto - excellent - -	1·27	59·6	34·	6·4	Capt. Johnston, 18th April 1840.
73	Boorhath, Assam - - -	Caking Coal, ditto - -	1·2	45·	52·7	2·3	Lieut. Strong, 24th June 1840.
74	Ditto, another bed - -	Cannel Coal, ditto - -	1·28	44·	48·	8·	Ditto - - - ditto.
75	Cheduba, Arracan - -	Ditto - inferior - -	1·30	46·8	41·2	12·	Capt. Bogle, July 1840.
76	Khota, Singrowly - -	Middling - - -	1·29	54·	32·2	13·8	Capt. Wroughton, 22d Sept. 1840.
77	Jubbulpore - - -	Excellent - - -	1·49	50·	47·1	2·9	Dr. Spilsbury.
78	Near Dearee, the Soan -	Middling - - -	1·42	37·6	58·1	4·3	Mr. Ravenshaw, 24th Nov. 1840.
79	Qulimany (Cape) - - -	Surface Coal - - -	1·6	23·2	40·16	36·6	From South Africa (Mozambique).
80	Tavoy River - - -	Cannel Coal - - -	1·72	62·	28·26	9·74	Mr. Blundell, February 1841.
81	Chittagong or Tippera Hills -	Good slaty Coal - - -	1·375	64·6	24·4	11·	Mr. Sconce, April 1841.
82	Petchelea Gulf - - -	Anthracite - - -	1·71	20·	74·	6·	Reed, through Captain Johnston, April 1841.
83	Doobradgapore - - -	Inferior slaty Coal - -	1·4	42·	38·	20·	Mr. Jas. Pontet, May 1841.
84	Jaipore, Upper Assam - -	Superior - - -	1·3	48·	46·2	5·8	Mr. F. R. Hampton, 8th July 1841.
85	Pulo Chermin, Borneo - -	Very superior - - -	1·34	64·	32·5	3·5	Marine Board, 8th November 1841.
86	Pulo Keng, Ayreng, Borneo -	Inferior - - -	1·39	43·	30·5	26·5	Ditto - - - ditto.
87	Bikrampore, Cachar - - -	Superior - - -	1·3	64·8	33·2	2·	Capt. Guthrie, Engineers, 7th March 1842.
88	Gudada River, Dhubary -	Inferior - - -	1·4	57·4	24·6	18·	Discovered by Mr. Js. Bedford, Assistant Revenue Surveyor, 1st February 1842, received from Major Jenkins.
89	Bunarussee Caribari Hills -	Brown Coal, burns freely -	1·4	50·	40·6	9·4	Ditto - - ditto, March 1842.
90	Mirampara, or Balajora Caribari Hills.	Ditto - - -	1·2	64·	26·	10·	Ditto - - ditto, March 1842.
91	Salkora, Caribari Hills -	Good brown Coal - -	1·3 to 1·4	70·	25·4	4·6	Ditto - - ditto, March 1842.
92	{ New Mine? - - - }	Superior - - -	1·3	36·	60·	4·	Major Henderson, August 1842.
93	{ Burdwan? - - - }	Very superior - - -	1·29	33·6	64·	2·4	Assistant Surgeon G. Playfair, late Surgeon of the Phlegothan, 1843.
94	† Shoughie (China) - - -						Major Jenkins, 24th April 1844.
95	Near the falls of the Jamoona (Assam).	Without exception the best specimen of Coal on the list.	1·2	46·	53·4	·6	Major Jenkins, 26th April 1844.
96	The bed of the Terro Nuddee (Assam).	Superior - - -	1·3	62·	35·2	2·8	Major Jenkins, 26th April 1844.
97	{ a. } Nicobar Islands - -	Weathered specimen - {	1·3	61·4	34·2	4·4	Messrs. Mackay & Co., 27th May 1845.
98	{ b. } " " " " " " " "		1·3	57·	40·	3·	
99	{ c. } " " " " " " " "		1·3	49·	46·	5·	
97	Dikhoo (Assam) - - -	Most superior - - -	1·3	28·	66·	·6	Capt. Rogers, 25th January 1845.
98	Diphoo, a tributary of the Jamoona, eight miles above the falls.	A dull earthy Coal - -	1·3	44·6	38·8	16·6	Messrs. Masters & Wood, March 1845.
99	Badam - - -	{ Very superior - - - }	1·29	32·	60·	8·	{ Col. Ousely, December 1845.
100	Jubbulpore - - -	{ Good - - - }	1·31	27·	61·	12·	
		Cannel Coal - - -	1·3	59·	37·	4·	Forwarded by Lieutenant Colonel Cox to the Agri-Horticultural Society, and sent for analysis by James Hume, Esq., 19th March 1846.

J. M'Clelland, Assistant Surgeon,
Secretary Coal Committee.

* The large proportion of carbon in this Coal would render it an excellent fuel if mixed with Cherra Coal, in which bitumen preponderates, while both might be had more reasonably at Dinapore than Burdwan Coal.

† Locality of the mine is about 15 miles from the mouth of a tributary of the Yanktse-Kiang called Woosung, which joins the former at a distance of 40 miles from the sea.

DESCRIPTION of the annexed MAP and SECTIONS, illustrative of the Distribution of COAL in *India*.

No fact is better established than that Coal was originally formed in small isolated or detached basins.

It is incorrect, perhaps, to say that the same bed may run to any very great or considerable distance, however appearances considered, without reference to full geological particulars, may seem to suggest such a conclusion. Lieutenant Hutchinson, in his Report on the Coal beds of Arrakan, refers the veins observed at Bolonga and Sandoway, though 200 miles apart, to one and the same bed; and Mr. Homfray, in a Report on Palamow Coal, dated 10th July 1837, states that it is traceable to Burdwan and Beerbhoom.

Such supposed connexion is, however, more apparent than real, and depends on the direction of mountains, rather than upon the original extension of the same bed, which can seldom be traced more than a few miles.

This fact in the history of Coal is of much practical importance; for however much the associated rocks may appear to be alike, we have reason to expect the local circumstances on which the value of the Coal depends to have something peculiar in them, in every situation in which it occurs.

West of the Ganges the best Coal is always either the deepest or most remote from water carriage. There may be exceptions to this rule, but we know the Hazareebaugh, the Surgooja, the Sohagepore, and the Nerbudda Coals to be superior to those of Burdwan, Cuttack, Rajmehal, and Palamow.

This we can explain from the fact which has been established by Mr. Murchison and others in the history of Coal, namely, that the main or richest and best beds are always lowest in the series. Being lowest, they consequently require to extend a greater distance at an inclined angle before they reach the surface. Thus, in the Section A, B, plate 2, the upper bed of Burdwan Coal crops out at Serampore (*a*), when the lower, or main Coal (*e*), extends 60 miles further into the hills before it crops out.

Out-crops of Coal are always arranged around or on the flank of mountains or disrupted strata. Parisnauth is the base to which the Burdwan Coal is inclined on the south-east, and the Ramghur beds on the south, Palamow on the north, and Rajmehal on the east.

The high lands of Mynpatt would also appear to be the base around which the Surgooja beds are arranged.

There may be a difference of quality and appearance between the upper, or surface, and the lower, or main beds of Coal; but still they both equally belong to the same formation.

Captain Tremenheere was therefore doubtless in error in supposing the impression of plants he observed in the Coal beds on the Great Tenasserim to be those of recent plants.

So also is Mr. Homfray most unquestionably in error in supposing the grasses he found growing over the Coal beds of Palamow to be those from which the Coal of that valley were formed.

Were those observations correct, such beds could not belong to the true Coal measures, as we know they do, from the nature of the mineral itself, as well as from other minerals and fossils with which it is connected.

Section C. D. plate 2, represents the general level from Hingolee to the coast.

Section G. H. plate 2, represents the same from Chotasgur to the coast. I. K. plate 1, represents a general section of the Coal formation from Silhet to Upper Assam, which, together with Section A. B. plate 2, and all similar sections throughout this Report, are only to be regarded as affording a general idea of the

subject rather than a correct representation of the form and disposition of the beds.

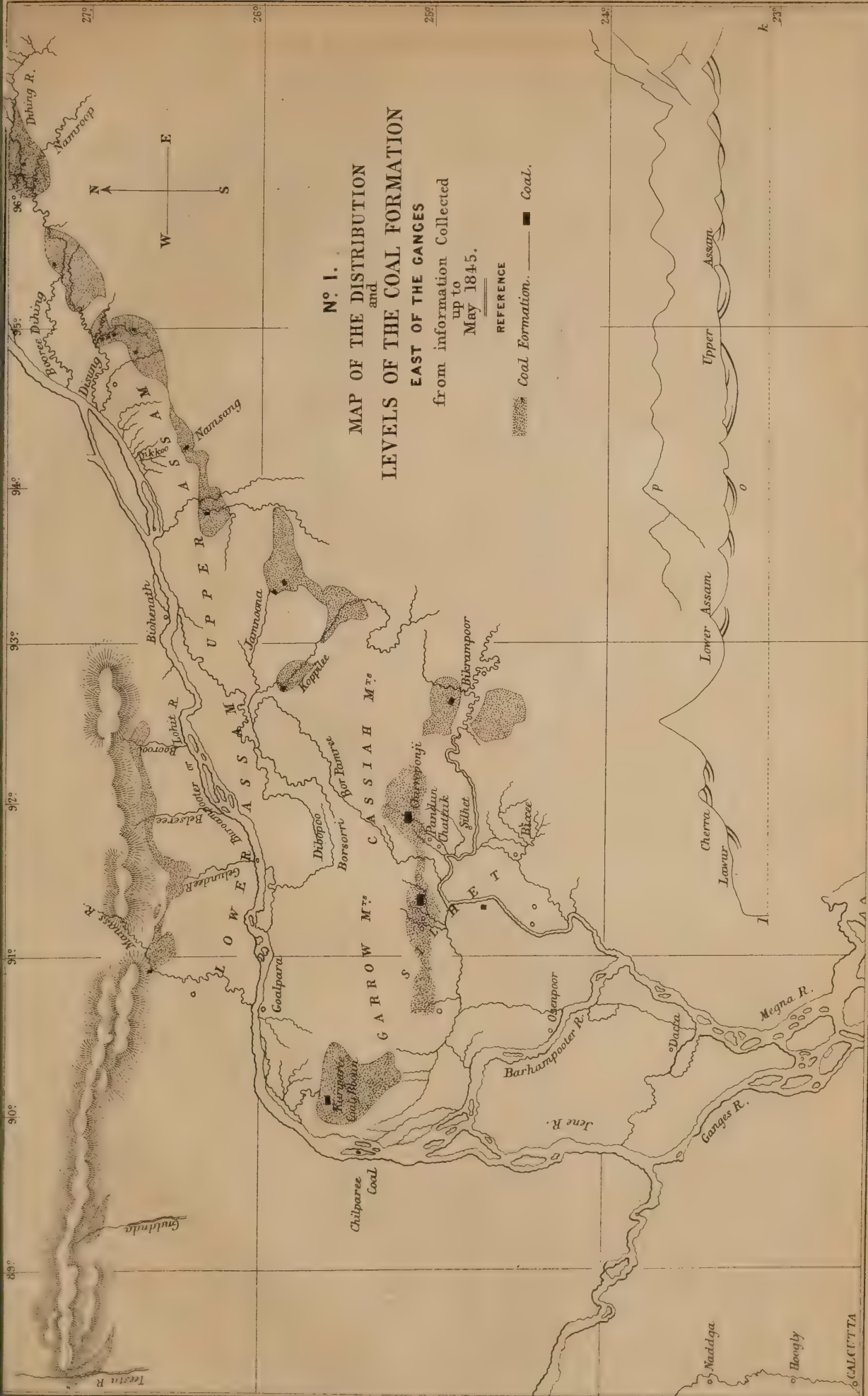
The Maps will require no further description, as they either explain themselves sufficiently, or are referred to in the text.

A skeleton Map, or Key to the Coal localities in India, has been prepared in the Surveyor General's Office, by order of Government, the Coal sites being marked on it from information on the records of the Committee, except the sites in Singrowlie, which are put down on the authority of Captain Wroughton.*

11 July 1845.

J. M. Clelland, Assistant Surgeon,
Secretary, Coal Committee.

* The map in question, together with the records of the late Coal Committee, have been made over to the Asiatic Society.



N^o 1.
MAP OF THE DISTRIBUTION
and
LEVELS OF THE COAL FORMATION
EAST OF THE GANGES
from information collected
up to
May 1845.
REFERENCE
Coal Formation. — ■ Coal.

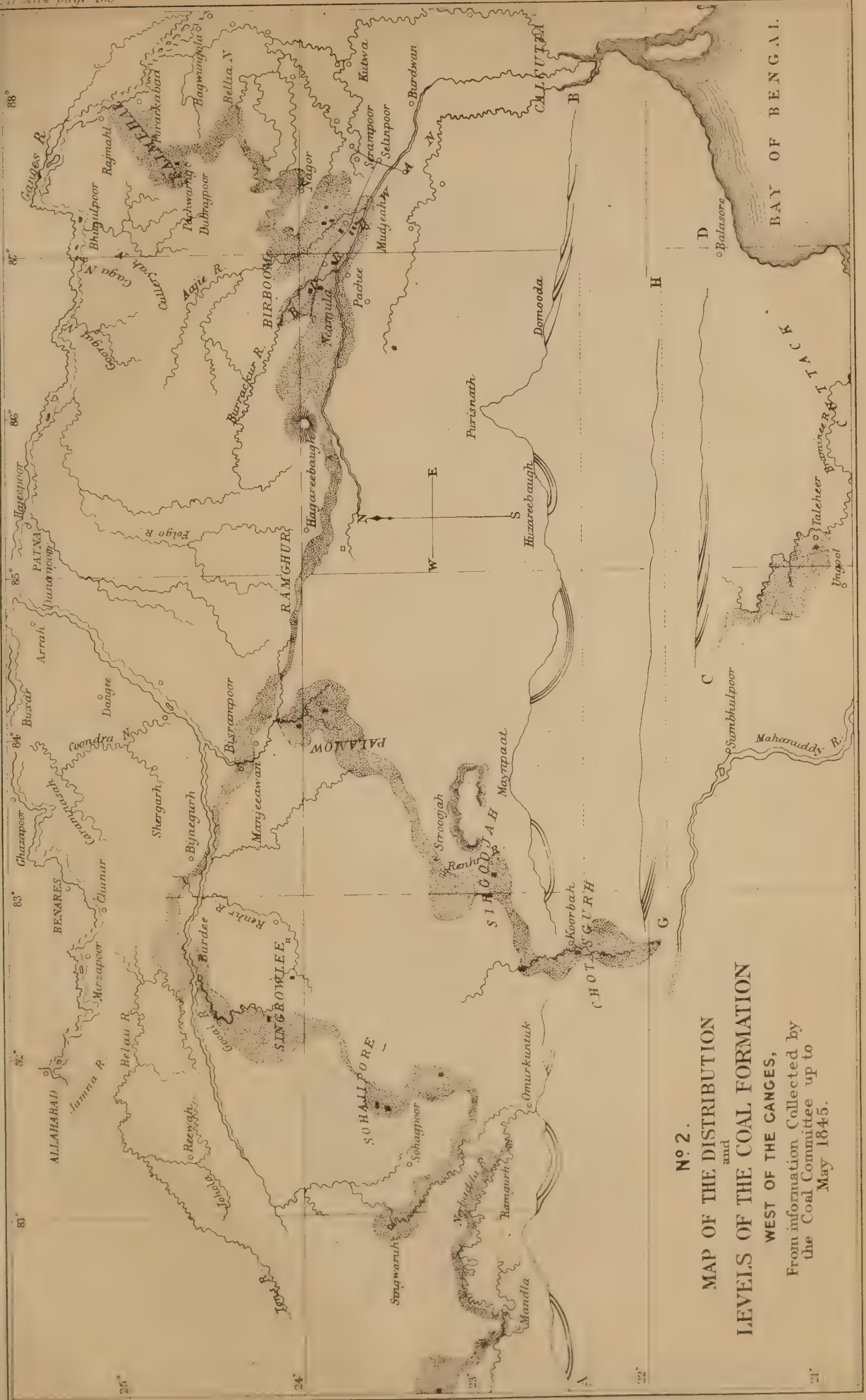


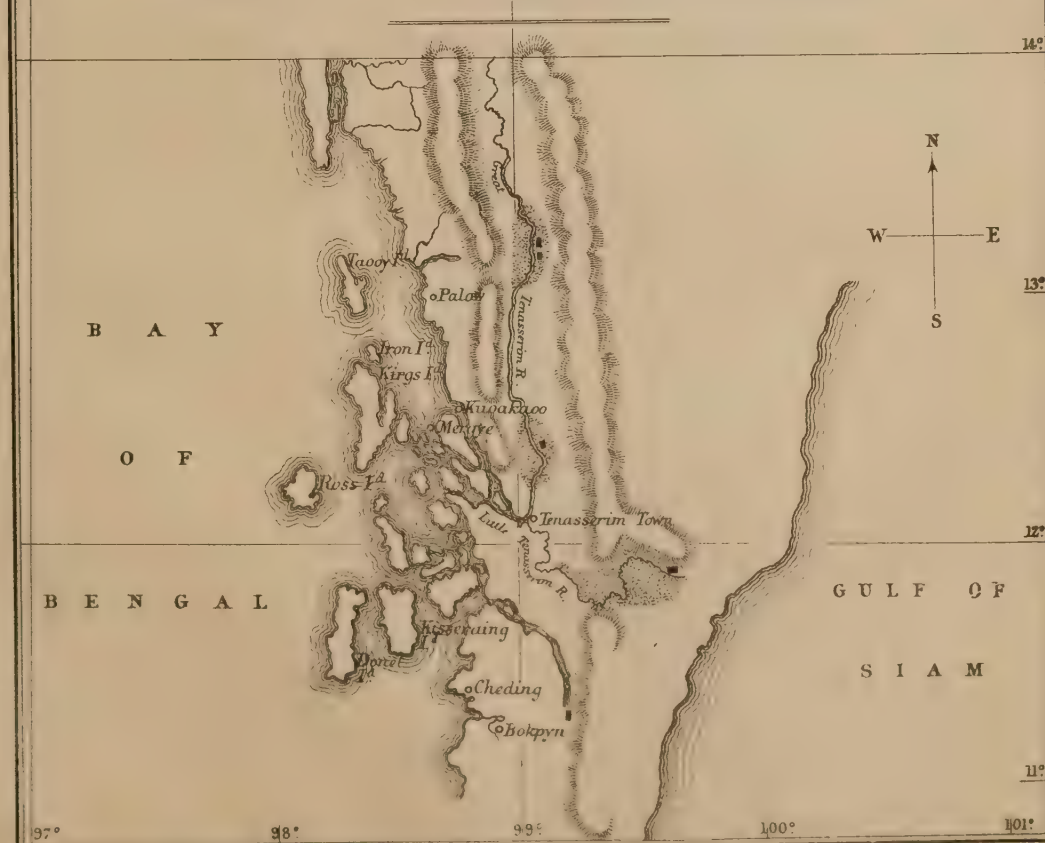
PLATE 3.

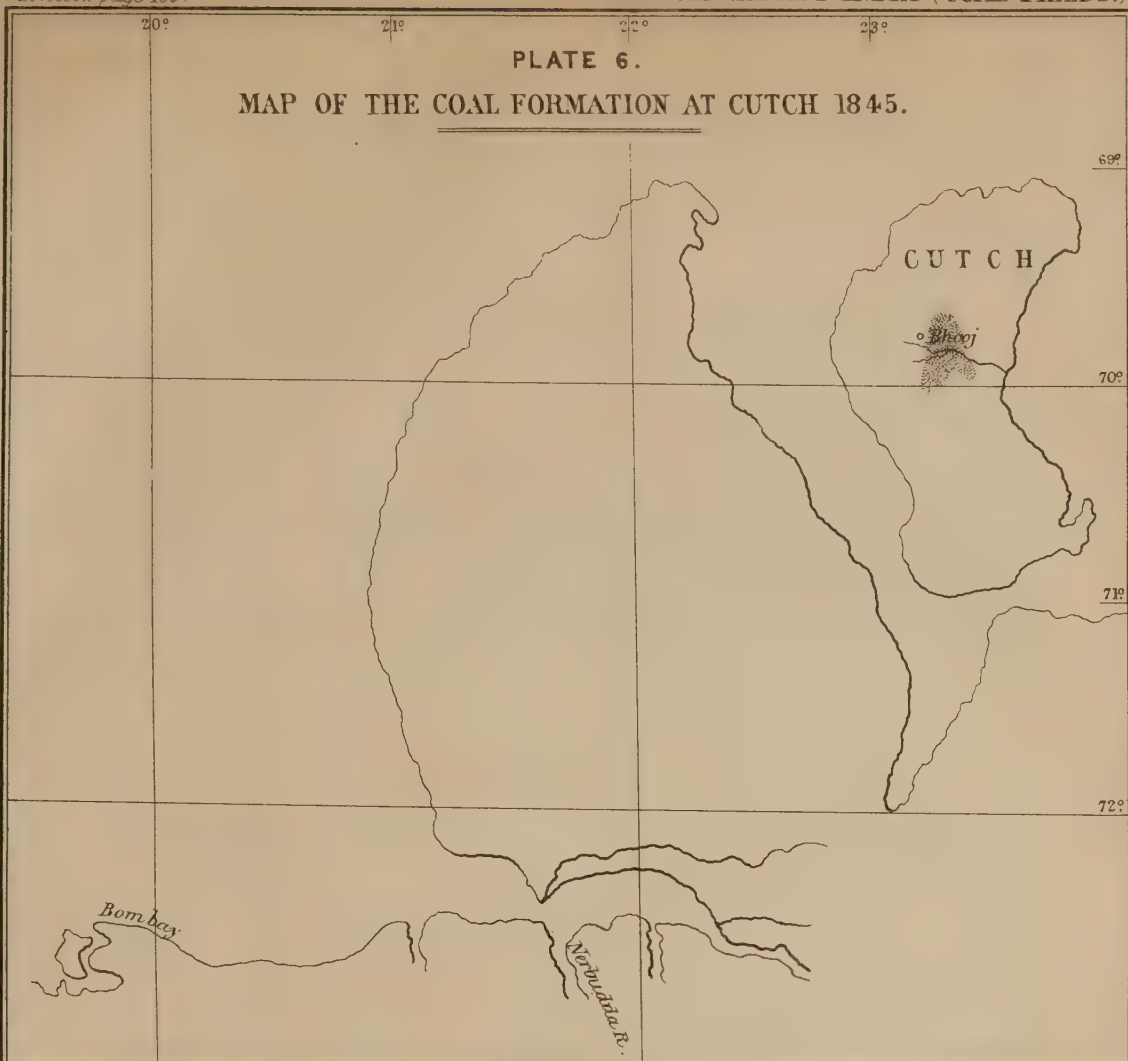
MAP OF THE COAL FORMATION AT ARRACAN 1845.



PLATE 4.

MAP OF THE COAL FORMATION AT MERGUE 1845.





RAJAH OF COORG.

RETURN to an Address of the Honourable The House of Commons,
dated 10 July 1863;—for,

“ COPY of the CORRESPONDENCE which has passed between Sir *J. S. Login* and *Robert Montgomery Martin*, Esq., as Executors of the WILL of the late Ex-Rajah of *Coorg*, and the Lords Commissioners of Her Majesty's Treasury, the Secretary of State for *India*, and the Court of Directors of the East India Company; and all DOCUMENTS connected with the subject to which the above Correspondence refers.”

India Office, }
21 July 1863. }

J. W. KAYE,
Secretary, Political Department,

(*Mr. Henry Baillie.*)

Ordered, by The House of Commons, to be Printed,
22 July 1863.

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25 April 1859	Mr. Lawford	J. C. Melvill	5
6 May "	Mr. J. C. Melvill	Mr. Lawford	5
30 June "	Sir C. Wood	Governor General	6
30 September "	Sir C. Wood	Governor General	6
30 "	Mr. Lawford	J. C. Melvill	7
1 October "	Mr. M. Martin	Secretary of State	7
3 " "	Messrs. Clarke, Gray, and Woodcock, with ex-Rajah's Will.	Secretary of State	8
7 " "	Sir C. Wood	Governor General	10
4 January 1860	Mr. Lawford	J. C. Melvill	10
20 " "	Mr. J. C. Melvill	Mr. Lawford	12
27 April "	Sir J. Login and Mr. M. Martin	Secretary of State	12
19 May "	Mr. Baring	Sir J. Login and Mr. M. Martin.	13
30 April "	Governor General	Sir C. Wood	13
16 November 1859	Superintendent of ex-Rajah	Cecil Beadon	14
9 " "	Officiating Civil Auditor, Allahabad.	Superintendent of ex-Rajah	15
13 December "	Under-Secretary, Foreign Department, with Governor General.	Superintendent of ex-Rajah	15
13 " "	Under Secretary, Foreign Department, with Governor General.	Officiating Secretary, Foreign Department, Calcutta.	16
19 " "	Superintendent of Ex-Rajah	Secretary to Government with Governor General.	16
24 October "	Secretary to ex-Rajah	Ranee Gunga Majee	16
27 December "	Under Secretary with Governor General.	Officiating Secretary, Calcutta.	17
20 March 1860	Officiating Secretary, Calcutta	Under-Secretary with Governor General.	17
6 February "	Officiating Under-Secretary, Calcutta.	Superintendent of ex-Rajah	17
25 " "	Superintendent of ex-Rajah	Officiating Under-Secretary, Calcutta.	18
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30 " "	Minute by Lord Canning	-	19
30 " "	Secretary with Governor General	Superintendent of ex-Rajah	19
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12 " "	Minute by Sir Bartle Frere	-	20
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22 November "	Mr. G. A. Hamilton (Treasury)	Sir J. Login and Mr. M. Martin.	33
31 January 1862	Sir J. Login and Mr. M. Martin	Treasury	33
7 March "	Mr. F. Peel (Treasury)	Sir J. Login and Mr. M. Martin.	35
28 July "	Sir J. Login and Mr. M. Martin	Under-Secretary	35
5 January 1863	Mr. Herman Merivale	Sir J. Login and Mr. M. Martin.	37

COPY of the CORRESPONDENCE which has passed between Sir *J. S. Login* and *Robert Montgomery Martin*, Esq., as Executors of the WILL of the late Ex-Rajah of *Coorg*, and the Lords Commissioners of Her Majesty's Treasury, the Secretary of State for *India*, and the Court of Directors of the East India Company; and all DOCUMENTS connected with the subject to which the above Correspondence refers.

PETITION from the Ex-Rajah of *Coorg*, to Her Most Excellent Majesty the Queen; dated 8 July 1858.

Showeth,

THAT in preferring to your Majesty the request which this petition contains, your petitioner desires to approach your Majesty's Throne with the assurance of the devoted loyalty, which, as one of your subjects, he bears to your Majesty, and of his gratitude for favours already graciously conferred upon him by your Majesty's royal acts.

It is not necessary to inform your Majesty that the petitioner who approaches your Throne, is the descendant of a long line of princes, hereditary sovereigns of an independent principality; and that, in the struggles which marked the progress of British power in India, those princes gave to the English cause the most efficient and faithful aid.

In the contest in which the English finally triumphed over their most formidable enemy, the Sultan Tippoo Sahib, the part taken by your petitioner's uncle determined the issue of the conflict, and secured, by the overthrow of the Sultan, the ascendancy of British power in the Mysore. The friendship and services of the Coorg Rajahs were acknowledged by those who represented your Majesty's illustrious family in India.

At a very early age your petitioner succeeded to a sovereignty thus allied to the English cause. Of the friendship which he himself upon every occasion showed to England and Englishmen, there exist testimonies too numerous to quote. Ruling over that mountainous territory of which his ancestors for centuries had been chiefs, in the midst of an attached and faithful people, possessing ample revenues, and surrounded by regal state, your petitioner continued up to 1834 in the enjoyment of his hereditary station.

In that year it was his misfortune, in the exercise of what he believed to be his duty as an independent sovereign, to give offence to that Company who then exercised the power of England in India. The armies of the Company entered his territory. To the general commanding those armies, your petitioner surrendered, without wasting life in a useless contest. He was at once deposed from his sovereignty, his territories were seized, his revenues confiscated, and he himself brought a prisoner of war to Benares.

Upon the events which led to this result your petitioner will only observe, that whatever may have been his errors of judgment, they were not marked by any conduct on the part of your petitioner which would impute to him anything of disgrace. He left the palace of his ancestors without the guilt of treachery, of bloodshed, of cruelty, or of broken faith. His crime was a mistaken assertion of his rights of sovereignty.

Your petitioner will not trouble your Majesty by inquiring how far these proceedings were justified by the events which led to them. The time may come when your Majesty may be graciously pleased, even after so long a period, to consider them.

Not only were the territory and public revenues, together with private treasures of your petitioner, taken from him, but payment has been refused of a large sum of money lent by your petitioner's ancestors to the East India Company, and vested in the public stock in the name of your petitioner—property resting

on the faith of nations, and hitherto held inviolable and exempt from the seizure of conquest.

A pension of 6,000 *l.* a year was given to your petitioner. For 17 years he was kept a close prisoner of war; and even now, at the end of 24 years, the Company claim to treat him as still their prisoner.

In the year 1850 your petitioner purposed to come to England for the purpose of having his daughter educated in this country. His visit to this country received the assent of the Court of Directors, signified through the Marquis of Dalhousie, your Majesty's Governor General.

To the last hour of his life your petitioner will remember with gratitude and pride the gracious acts of your Majesty in relation to his dear child—acts which have assured him of your Majesty's royal kindness, and have consoled him under all the adversities he has endured.

In March 1852, your petitioner arrived in this country. He was compelled to come under the care of an officer of the East India Company, for whose expenses he was obliged to pay very large sums of money, which he could ill afford. After he had remained a short time in this country, the East India Company threatened to cut off altogether your petitioner's means of support by withdrawing the allowance which they made him, unless he instantly returned to Benares.

At this time your petitioner had appealed to your Majesty's High Court of Chancery to obtain redress against the Company for withholding from him his right to the public stock which belonged to him. The injustice of compelling him to leave this country while he was a suitor in your Majesty's Courts was so plain that one of the Peers of this realm brought the subject before the House of Lords, and the Court of Directors permitted your petitioner to remain in England until the termination of his suit against the Company.

That suit is now, your petitioner hopes, drawing to a close; and at its termination the claim will be renewed of the power to send your petitioner from this country, and compel him to reside as a prisoner at Benares.

Your petitioner's own wish would be to return to India. He desires to make arrangements for the education of some of his sons in this country, but he wishes to return with those sons to England.

Under these circumstances, he humbly prays that your Majesty may interpose the generous exercise of your royal prerogative, and give commands that your petitioner may be free from all restraint, and at liberty to reside either in this country or in India, as he pleases. Whatever cause of complaint may have existed against your petitioner when in the reign of your Majesty's royal uncle the Company made war upon him has surely been atoned for by your petitioner's sufferings and his long imprisonment in exile. To those of your Majesty's own subjects who took arms in your realm against you, your Majesty has been pleased to extend that gracious pardon which has freely restored them to their country and their homes.

The offence of your petitioner is that, 24 years ago, when sovereign of an independent principality, he resisted acts of the East India Company which he then thought inconsistent with his rights; no disgrace, no treachery nor unfair dealing can be imputed to him in these unhappy transactions. If he has erred, he has paid a severe penalty for his error. To enforce the power of the Company, the troops of the Sovereign of England were marched against him. He was compelled to yield to the armies to which mightier nations have bowed, and, after 24 years of exile, and many of these years of virtual imprisonment, he now appeals to the mercy of your Majesty, as one of your Majesty's most loyal and devoted subjects, but at the same time as a fallen sovereign prince, whose fortunes the fate of wars has placed at the disposal of your Majesty. He asks that he may be no longer regarded as a prisoner of war, but may, by your Majesty's gracious act, be left free to pass the rest of his days wherever a wish to promote the best interests of his children may lead him.

One further request he ventures humbly to make to your Majesty. As he is now approaching the limits of old age, he feels deep anxiety that a suitable provision may be made for his children after his death. He humbly trusts that instead of the pension at present enjoyed by him, a grant of lands may be made to your petitioner, in free jagheer, equivalent to that pension and to the money due to him in the Company's stock, to descend after him to his heirs, and in the possession of which your petitioner's descendants may, to remote generations,

show,

show, as their ancestors had already done, their loyalty and attachment to the British.

These two requests your petitioner, with all humility, prefers to your Majesty. He appeals to his misfortunes as giving him a claim to your Majesty's kindness. He appeals to his conduct during 24 years of his fallen state, as entitling him to that favour, and he waits to receive from your Majesty's goodness the boon which will bring happiness and contentment to his declining years.

Your petitioner, therefore, humbly prays that your Majesty may direct that your petitioner may be freed from all restraint, and be permitted to pass freely from this country to India, and from India here; and further, that your Majesty may be pleased to order that he may be granted such lands in India as may secure to his children a provision suited to their rank and becoming the dignity and clemency of the British Crown.

And your petitioner will ever pray, &c.

J. C. Melvill, Esq., to the Ex-Rajah of Coorg; dated East India House,
16 September 1858.

I AM directed by the Secretary of State for India in Council to inform you that he has received Her Majesty's commands to state, in reply to your petition, that a copy of it will be sent out to the Governor General of India in Council for his observations with respect both to your continued residence in England and to the desired provision for your family. When an answer from that authority has been received, his Lordship will be prepared to consider the subject in Council.

H. S. Lawford, Esq., to *J. C. Melvill, Esq.*

Drapers' Hall, 25 April 1859.

ADVERTING to my recent report upon the state of suits now pending, I have the honour to call your attention to the very unsatisfactory position in which the proceedings in Chancery, instituted by the ex-Rajah of Coorg against the East India Company, are now left, in consequence of the refusal of the Master of the Rolls to make the usual order for diminishing the plaintiff's bill in default of his prosecuting the suit without further delay. Under these circumstances, I have thought it necessary to lay the accompanying instructions before counsel to advise upon the course to be adopted, and have to request that you will submit their opinion, which will be found at the foot of the instructions, to the Secretary of State in Council. And, in accordance with the recommendation therein contained, I would submit that I be authorised to make the communication to the plaintiff's solicitors suggested by counsel, and to take such other steps in the future conduct of the case on behalf of the defendants as, in the opinion of counsel, may be considered advisable.

J. Cosmo Melvill, Esq., to *H. S. Lawford, Esq.*; dated India Office,
6 May 1859.

WITH reference to your letter of the 25th ultimo, soliciting the instructions of the Secretary of State for India in Council with respect to the pending suit of "Veer Rajunder Wadeer (ex-Rajah of Coorg) *versus* the East India Company," I am instructed to communicate to you the opinion of his Lordship in Council, as follows:—The ex-Rajah of Coorg has instituted a suit in Chancery against the East India Company for the recovery of certain sums of money which he alleges to be illegally withheld from him. He has also petitioned the Home Government

of India to allow him to reside in England after the adjudication of that suit; and, also, to make a provision for his family after his death. The petition of the ex-Rajah has been referred to the Government of India. To this reference no reply has yet been made.

The Secretary of State for India does not perceive that the petition has anything to do with the Chancery suit.

The one involves a legal, the other a political question. Her Majesty's Government desire that each question shall be decided on its own merits. They are not disposed to make any bargain with the ex-Rajah of Coorg.

If the money claimed by the ex-Rajah be justly due to him, Her Majesty's Government can have no desire to evade its payment by holding out to him any inducement to forego his claims for the sake of other desired advantages. And if it be just and politic to grant the prayer of his petition, they can in no way be influenced to refuse it by any considerations connected with the suit.

You are desired, therefore, to make every effort to bring the proceedings in the case of "*Veer Rajunder Wadeer versus the East India Company*" to a decision on its own merits, with the utmost possible despatch.

Political Department.

Sir Charles Wood to the Governor General of India; dated 30 June
(No. 30) 1859.

Para. 1. I HAVE to invite the attention of your Excellency to the letter of the Secretary of State for India in Council, No. 3 of 1858, in the Political Department (dated 13th October), enclosing a memorial from the ex-Rajah of Coorg, and requesting the opinion of your Government respecting the different matters touched upon in the petitioner's appeal.

2. Adverting to the long-pending suit of the ex-Rajah *versus* the East India Company, and to the very critical state of the ex-Rajah's health, I am apprehensive that the public interests may suffer by the postponement of your reply, and I have, therefore, to request that you will furnish me with the views of your Government, with the least possible delay.

Political Department.

Sir C. Wood to the Governor General of India; dated 30 September
(No. 46) 1859.

1. I HAVE to inform your Excellency that the ex-Rajah of Coorg died, in London, on the 24th of September.

2. I am informed that the ex-Rajah left a will, in which he has named Sir John Login and Mr. Montgomery Martin as his executors. But I do not know whether they are prepared to act in that capacity. You will, of course, instruct the Commissioner at Benares to take the necessary steps to secure the property of the deceased.

3. With reference to my Despatch of the 30th of June, I have to request that you will, as expeditiously as possible, furnish me (if not already forwarded) with the opinion of your Government, respecting the provision to be made for the family of the ex-Rajah.

H. S. Lawford, Esq., to J. C. Melvill, Esq.; dated Drapers' Hall, 30 September 1859.

I HAVE the honour to report, for the information of the Right Honourable the Secretary of State in Council, that I have received a letter from the solicitors to the ex-Rajah of Coorg, acquainting me with the death of their client on Saturday the 24th instant, and the consequent abatement of the suit in Chancery, instituted by him against the East India Company.

I will take the necessary steps for the purpose of having his bill dismissed as soon as administration to his late Highness has been obtained in this country, unless it should be the intention of his representatives here to revive the suit.

*R. Montgomery Martin, Esq., to the Secretary of State for India;
dated 1 October 1859.*

Sir,

I BEG to inform you, for the information of the Council of India, that the ex-Rajah of Coorg died in London on the 24th ultimo. A few hours before his death I was written to by his solicitors, and informed of his approaching demise; they also stated that they had in their possession a will, and that I was named as one of the executors; and they further informed me that a considerable amount of property had already been carried off from the house of the dying prince; that there was a large mass of jewels still in the house, which they feared would be abstracted, and they requested my advice on the subject. I replied that no information had previously been given to me about the will; that the Rajah had often sought my advice on his affairs; but if the solicitors were certain that I was named as an executor (along with Sir John Login, who was not in London), they had my orders to secure all the property of the Rajah, and to place a seal upon it. On my arrival in London the Rajah was dead; I secured as much of the property as I could find, placed on it the seals of the solicitors, and European secretary of the Rajah, together with my own seal, after having the jewels inventoried and described by Ryder and Hancock, the jewellers. The jewels are now deposited under seal, in the fireproof department of the London and Westminster Bank, Lothbury. There being no one to act, I undertook the interment of the Rajah, who died from a lingering disease of the liver and lungs; latterly, indeed, he refused sustenance, and expressed his disinclination to life. I have had his body placed in a lead and oak coffin, in No. 1 of the unconsecrated catacombs at Kensal Green Cemetery. The funeral was conducted in a manner befitting the rank of the deceased; a portion of the beautiful burial service of the Church of England was read in the chapel to a large auditory, by the Rev. W. Arthur, now Secretary to the Wesleyan Mission, in London, formerly a missionary in Mysore, and conversant in the language of the Rajah (Canarese). Mr. Arthur, who had been intimately acquainted with the Rajah for many years, and knew his favourable opinions with regard to Christianity (though he had not been baptized), felt justified in the performance of a funeral service, address to the congregation, and most solemn prayer for the soul of the deceased, prefaced, however, by the clear declaration that the Rajah was not claimed as a convert to Christianity, but that he was viewed as an exile, who had died in a foreign land. The service gave great satisfaction to the audience. I send by the book-post of this date a copy of the presumed will of the ex-Rajah of Coorg. Sir John Login, the other executor named, has not yet consented to act, and has postponed his decision on the matter. I have sent to Lord Broughton, to Sir J. W. Hogg, and to Lady Catherine Harcourt, copies of this will, and of the correspondence with Sir John Login, of which, if desired, the Council shall also have a copy. Sir John Login, in a letter to me of 30th September, says, "You appear to have taken every means in your power to secure the property," and that he "will take time to consider the course which he (I) will adopt." There is, however, no time to be lost in securing the property of the deceased prince at Benares for the benefit of all the members of his family. I do not know what may be the amount of that property. I hear of one sum of 11,000*l.* in money, and of a large mass of jewels, some in a large chest in the house of the Rajah at Benares, and some buried

under or near the house. As I am now acting as executor, and contemplate placing the will under the direction of the Court of Chancery, to which I will hand over the jewels and property now in my possession, I solicit, as an act of justice and of humanity, that instructions be sent to the Resident at Benares to secure and place under seal the property in the house of the Rajah at Benares, and any other property which may be found in India belonging to the estate. These instructions may, I hope, be sent by Marseilles, or better still, by telegram. Not knowing whether Sir John Login would co-operate with me as an executor to the presumed will of the Rajah, I was not in a position, until this morning, to make the official application, or to convey the information contained in this letter. Should the Council of India have any instructions to give me on the subject, they shall be promptly attended to. I trust that the Secretary of State for India will deem that I have fulfilled my duty.

Messrs. *Clarke, Gray & Woodcock*, to the Secretary of State for India;
dated 3 October 1859.

Re Rajah of Coorg, Deceased.

By the directions of R. M. Martin, Esq., one of the executors named in the last will of the Rajah of Coorg, we beg to forward a copy of his Highness's will, respectfully requesting that you will be good enough to send, by this mail, an order to the authorities at Calcutta to secure all property belonging to the late Rajah at Benares.

WILL and CODICILS of Veer Rajundeer Wadeer.

This is the last Will and Testament of me Veer Rajundeer Wadeer ex-Rajah of Coorg now residing at Nuraber 20 Clifton Villas Warwick Road Paddington in the County of Middlesex in the Kingdom of England. I appoint Sir John Login of Church House Kew in the county of Surrey and Robert Montgomery Martin of Gloucester-terrace Camden Hill Kensington in the said county of Middlesex Esquire trustees and executors of this my Will I direct all my just debts funeral and testamentary expenses to be paid with all reasonable speed after my death I give to each of them Soobedree and Modree (the two Indian females whom I brought from India and are now resident with me) the sum of One thousand pounds free of legacy duty and also all their clothes and such articles of jewellery as have been usually worn by them respectively the same to be for their separate use and benefit free of legacy duty I give three hundred rupees to each of my concubines residing at or near Benares in the East Indies free of legacy duty I give each of my said executors the sum of one hundred pounds free of legacy duty if he acts as such trustee and executor as aforesaid I give to Ali Ackbar of Number 235 Maida Vale Paddington in the county of Middlesex the sum of one hundred pounds free of legacy duty I also give

to the said Ali Ackbar my ^{two} brougham ^{two} carriages and ^{all} grey horses both free of legacy duty I give to Mr. John James Birkett of Number 20 Clifton Villas Warwick Road Paddington gentleman the sum of fifty pounds I give to Adolphus Richardson who is in my service as coachman the sum of nineteen pounds nineteen shillings free of legacy duty I give to each of my other servants living with me at the time of my death the sum of five pounds All my jewels and trinkets and articles of jewellery which I have now in England I direct may be sent to my Ranee who is now at Benares and I give and bequeath the same to her and my other wives and children there in equal shares and proportions And I direct her to give and divide the same amongst them accordingly for her and their own use and benefit I also direct that a list shall be made of the said jewels trinkets and articles of jewellery and that a copy of such list shall be made and the same together with the said jewels trinkets and articles of jewellery delivered to Soobedree and Modree the two Indian females who are now resident with me and who will return to India on my decease for the purpose of their giving and delivering the said list and the said jewels trinkets and articles of jewellery to the said Ranee In case my said executors should in their discretion see fit to send the said jewels trinkets and articles of jewellery to my said Ranee by any other means than by the said Soobedree and Modree I hereby authorize and empower them to do so and to send them in any other way they may see fit I give devise and bequeath all the rest residue and remainder of my estate whatsoever and wheresoever both in India, England, and elsewhere and also all property whatsoever and wheresoever over which I have any power of appointment or disposal unto the said Sir John Login and Robert Montgomery Martin their heirs executors and administrators upon trust to divide the same amongst such of my three wives (who are now resident at Benares aforesaid) and such of my children both legitimate and by reputation as shall be alive at the time of my decease

in

(Rajah's signature.)
Witness,
Jos. Woodcock,
solicitor, 20, Lincoln's
Inn Fields,
Wm. Cooper Ryland,
clerk to Messrs. Clarke,
Gray & Woodcock.

in such shares and proportions as they respectively would be entitled to the same according to Hindoo law I hereby authorise and empower my said executors or the survivor of them or other the trustees or trustee of this my will or the person or persons who for the time being shall be my personal representative or representatives at their or his own absolute discretion to carry on and prosecute or to refer to arbitration or compound or otherwise settle or to discontinue the suit in the High Court of Chancery in England which I have instituted against the late East India Company, and now in prosecution against the Secretary of State in Council of India; and also to institute and prosecute any other proceedings in any court of judicature for recovering and enforcing payment of the monies, the subject-matter of the said suit, I earnestly request and implore the Government of India, administered in the name or on behalf of the Sovereign of England, to pay to or for the benefit of my said three wives and my said children the pension which has been hitherto paid to me, or for my use, by the Government of India, or to make some other suitable provision for them. In case the said Sir John Login and Robert Montgomery Martin, or either of them, or any future trustees or trustee of this my will, shall die, refuse, or become incapable to act in the trusts thereof, it shall be lawful for the survivor or continuing trustee, or the retiring or refusing trustee or trustees, to appoint some other person or persons in his or their place or places to be a trustee or trustees of this my will; and thereupon all the trust estate and premises shall vest in the new trustees jointly with the surviving or continuing trustee, or in the new trustees only (as the case may be); and every new trustee shall have the same powers and authorities as if he had been originally appointed a trustee by this my will. I hereby authorise and empower every person acting as a trustee or executor of this my will to reimburse himself all costs and expenses incurred by or occasioned to him by reason of his being such trustee or executor as aforesaid. I hereby revoke all former testamentary papers, and declare this only to be my last will and testament. In witness whereof I, the within-named Veer Rajundeer Wadeer, the testator, have to this my last will and testament contained in this and the two preceding sheets of paper, set my hand this 20th day of June 1859.

Signed and declared by the said Veer Rajundeer Wadeer, the testator, as and for his last will and testament (the same having been first translated and interpreted to him in the Hindostanee language), in the joint presence of us who, in his presence, and at his request, and in the presence of each other (all being present at the same time), who have hereunto subscribed our names as witnesses; the word "two" and the word "all," on the 20th line of the first sheet, having been inserted and interlined previous to the execution thereof by the said testator.

(Rajah's signature.)

Jos. Woodcock, Solicitor,
20, Lincoln's Inn Fields.

Wm. Couper Ryland,
Clerk to Messrs. Clarke, Gray & Woodcock.

His Highness Veer Rajundeer, Rajah of Coorg, has this day expressed a wish that the two Indian ladies, now residing with him, are to receive from the executors, independent of the legacy bequeathed to them, money for first-class passage from England to Calcutta each of them separately; and the time of their departure from this country is left entirely at their option to leave whenever they may feel disposed to do so.

20, Clifton-villas, Warwick-road, West,
Maida-hill,
20 September 1859.
(Rajah's initials.)

I interpreted this to his Highness,

M. A. Ackbar.

Witness to the signature, *J. J. Birkett.*

I request my executors to pay to my medical attendant, Mr. Bates, the sum of 20*l*.

21 September 1859.

(Rajah's initials.)

I interpreted this to his Highness.

M. A. Ackbar.
J. J. Birkett.

His Highness the Rajah desires his executors not to call upon the Indian ladies to account for the balance of money which may remain in their hands, and his Highness has left it to them, the balance, for their own use after his death

24 September 1859.

(Rajah's initials.)

I interpreted this to his Highness,

M. A. Ackbar.

Witness to the signature, *J. Jas. Birkett.*

Political Department.

Sir *C. Wood* to the Governor General of India; dated 7 October (No. 49) 1859.

WITH reference to my letter of the 30th September (No. 46) 1859, I transmit to you herewith, for the information of your Excellency's Government, a copy of the will of the late ex-Rajah of Coorg, and of a letter relating to it, from Mr. R. Montgomery Martin, one of the executors named in the said will.

H. S. Lawford, Esq., to *J. Cosmo Melvill*, Esq.; dated Drapers' Hall,
4 January 1860.

I HAVE the honour to report that the solicitors to the late ex-Rajah of Coorg have sent me a proposal, of which the enclosed is a copy, for compromising the suit instituted by the ex-Rajah against the East India Company, and which has been ordered by the Master of the Rolls to be revived by the executors on the 11th instant.

The proposal, though professing to contain terms for a compromise, suggests, in fact, nothing less than a surrender by the Government of the whole claim in dispute, the opposition to which by the East India Company has occasioned so much expense, and which is at length, after protracted proceedings of more than five years' duration, upon the eve of being judicially decided. The so-called compromise is also based upon a statement which, in several important particulars, is incorrect, especially the allegation respecting the legal and equitable claims of the ex-Rajah to the notes, so far as claimants other than the Government are concerned.

As the time for reviving this suit is close at hand, it is very desirable that I should be furnished with definite instructions, whether to proceed at once, or consent to a postponement to give time for the consideration of the proposal by Government; and if the latter course is determined on, I would take the liberty of suggesting that I be authorised to take the opinion of the standing counsel, and the counsel engaged in the suit, upon the expediency of entertaining a compromise upon the terms now offered, or upon any other terms. And I would further submit that, if practicable, Mr. Wigram should be associated with them in advising upon this question. He is so thoroughly conversant with all the details of the case, that I think it would be a misfortune if his opinion were not obtained, supposing him willing to attend a consultation upon the subject.

IN CHANCERY.

BETWEEN Veer Rajundeer Wadeer, ex-Rajah of Coorg (now deceased)	} Plaintiff.
and	
The Secretary of State in Council of India, who has come in the place of the East India Company - - - - -	} Defendant.

STATEMENT and PROPOSITIONS on behalf of Sir John Spencer Login and Robert Montgomery Martin, Esq., the Executors of the late Rajah of Coorg, for a compromise of the ex-Rajah's claims in this suit.

States,—

1. THE bill was filed in this cause on the 17th day of June 1854 by Veer Rajundeer Wadeer, the ex-Rajah of Coorg, against the Honourable the East India Company for the purpose of recovering payment from them of the amount due on two promissory notes, together with interest thereon, from the year 1832 to the present time, the one of which promissory notes is dated the 1st day of May 1832, and is for 2,03,900 rupees, and the other of such promissory notes is dated the 1st day of February 1811, and is for 6,53,940 rupees, making, together, 8,57,840 rupees.

2. The

2. The suit was in a position to be set down for hearing, but before it was set down, and on the 25th day of September 1859, the Rajah departed this life, having first duly made and published his last will and testament, bearing date the 20th day of June 1859, and appointed Sir John Spencer Login and Robert Montgomery Martin, Esq., executors thereof, who duly proved the same in the Principal Registry of Her Majesty's Court of Probate, on the 2d day of November 1859.

3. That in the will of the said Rajah is contained a clause with reference to the said suit of which the following is a copy:—"I hereby authorise and empower my said executors "or the survivor of them or other the trustees or trustee of this my will or the person or "persons who for the time being shall be my personal representative or representatives at "their or his own absolute discretion to carry on and prosecute or to refer to arbitration or "compound or otherwise to settle or to discontinue the suit in the High Court of Chancery "in England which I have instituted against the late East India Company and now in "prosecution against the Secretary of State in Council for India and also to substitute or "prosecute any other proceeding in any court of judicature for recovering and enforcing "payment of the monies the subject matter of the said suit. I earnestly request and implore "the Government of India administered in the name or on behalf of the Sovereign of "England to pay to or for the benefit of my said three wives and my said children the "pension which has been hitherto paid to me or for my use by the Government of India "or to make some other suitable provision for them."

4. That the said Sir John Spencer Login and Robert Montgomery Martin did, on the 16th day of November 1859, file their bill in this Honourable Court against the Princess Victoria Gouramma of Coorg before his Honour the Master of the Rolls, praying, amongst other things, that it might be referred to the chambers of the judge to whose court this cause is attached to inquire and certify whether any and what proceedings should be taken by the plaintiffs in reference to the said suit by the said testator against the East India Company, and now against the Secretary of State in Council of India, or in reference to the claims by the said testator mentioned in the said suit, or whether the plaintiff should (if the Secretary of State in Council of India should be willing), under what terms and conditions, compromise the said suit, or the claims of the said testator therein mentioned.

	Per annum. Co.'s Rs.
5. During the lifetime of the Rajah, the Indian Government allowed him a pension which now reverts to them of - - - - -	60,000
Under ordinary circumstances it is assumed that this pension would now have been reduced to his family to one-half, say - - - - -	30,000
But in consequence of one of his daughters, the Princess Victoria Gouramma, having been educated in England, in a position of life which entails great expense, an addition must be made to the sum (and which has already been settled on her) of a sum of - - - - -	10,000
And the whole annual allowance to be granted to his family by the Government, would, therefore, probably amount to two thirds of the late Rajah's pension, viz. :— - - - -	40,000

But the Rajah had a claim against the Indian Government on the above-mentioned promissory notes for sums deposited in the public loans, amounting, in 1832, as above stated to 8,57,840 Company's rupees=85,784 £, which with accumulation of interest, at 4 and 6 per cent. for 27 years, now amounts to, say 21,37,430 Company's rupees=213,743 £, yielding an annual interest at 5 per cent. the present rate of 1,06,871 Company's rupees=10,687 £.

6. The Indian Government, however, it seems considered themselves justified in withholding these sums, both principal and interest, from the late Rajah, who had risen in arms against them.

7. But though the East India Company may have been justified when, as the result of the war, they had conquered his territory, and the Rajah had surrendered himself into their hands, in seizing the territorial revenues of Coorg, to indemnify themselves for the expense of the war, the principles of international law do not sanction the appropriation in such a case of the private property of the deposed Rajah, and it should not be forgotten in dealing with his children, that the Company were under deep obligations to his family, more especially to his uncle, who rendered them great service in assisting them to crush the power of Tippoo Sultan.

8. It is not denied that the capital sum has never been sequestered to the Indian Government, but remains in the public Treasury, with interest accruing thereon, and that for the last 27 years no claimant but the Rajah has ever appeared for it.

9. If, even according to the laws and usages of India, the Government has been right in refusing this sum, and its accumulations, to the late Rajah; and in giving him only a pension sufficient to support himself and family in a suitable manner, on the annexation of his territories (from which he had also been exiled), are they equally justified in refusing it to his children, and in preferring to continue them as State pensioners, dependent upon their bounty rather than acknowledge their claims to this fund, and afford them opportunities of improving their circumstances by employing it?

10. Even if it should be shown that there may have been some doubts at first as to the validity of a portion of the claim made by the Rajah, yet as 27 years have elapsed without any claimant presenting himself, during the whole of which period the Indian Government

have had their officers in charge of the country, and must have known if any claim had been made adverse to the Rajah's rights; and as they actually paid the interest on both the notes to the Rajah down to the time of his deposition, there cannot be a doubt that he is both legally and equitably entitled to the whole of the money which was claimed by him.

11. There are said to be 11 children to whom, on an average, this fund would provide a yearly allowance of say 9,716 rupees each (971 £.), if the principal is invested in Government Stock, or a portion for the sons might be apportioned for purchase of land in India, or commuted for Jagheers.

12. Arrangements might be made in the family for the support of the Ranees and dependents.

13. If it be thought expedient to augment the portion of the Princess Gouramma, who, from having been placed in a peculiar position, may require it more urgently, arrangement might be made for reversions to her and her heirs, on failure of direct issue in other branches of the family.

14. The result to the Indian Government from the annexation of the principality of Coorg has then been thus:—

For the expenses of the Coorg war, and the removal of the Rajah and his family to Benares, and a life annuity to the Rajah of 60,000 rupees per annum, they have obtained the revenues of Coorg for 25 years, all public property therein, an improved political position in a country suitable for European settlements, and the substitution of a comparatively civilised family for lawless and arbitrary chiefs.

That in pursuance of the above mentioned power and authority contained in the will of the said Rajah, enabling them in that behalf, the said Sir John Spencer Login and Robert Montgomery Martin propose by way of compromise of this suit, that the said sum of 21,37,430 rupees shall be appropriated for the benefit of the family of the said ex-Rajah of Coorg, in such manner and in such proportion as the Government of India may see fit and determine.

*J. Cosmo Melvill, Esq., to H. S. Lawford, Esq.; dated India Office,
20 January 1860.*

I AM directed by Sir Charles Wood to acknowledge the receipt of your letter of the 4th instant, and to inform you in reply, that he concurs in the opinion expressed by Lord Stanley in my letter of the 6th May last, and that he declines to enter into any compromise with the executors of the ex-Rajah of Coorg. You will communicate this to the parties concerned, and expedite the hearing of the cause as far as lies in your power.

*Sir J. Login, and R. M. Martin, Esq., to the Secretary of State for India;
dated 27 April 1860.*

HAVING ascertained by letter, lately received from Benares, that no provision has yet been made by the Government of India for the continuance of a State pension to the family of the late ex-Rajah of Coorg, and that they are consequently exposed to great distress and inconvenience, we take the liberty, as executors under the will of the late ex-Rajah, to request the favourable consideration of Her Majesty's Government to their case.

When, on a late occasion, we submitted proposals for the settlement of the claims of this family to certain funds held in the name of the late Rajah Veer Rajundeer Wadeer, now amounting, with interest, to 213,743 £. sterling, and for which a suit had been entered in Her Majesty's courts by his late Highness against the late East India Company, we hoped that it would have been in your power to sanction such a compromise of that claim on behalf of the family of the deceased Rajah, as would prevent the necessity of asking the favour of Her Majesty's Government to continue the pension to them.

Although we still consider the claims of the family to be such as warrant us in prosecuting the suit against the late East India Company, and that both by law and precedent, "as in the case of the property of the late Rajah Suchet Singh, in which the claims of Maha Rajah Duleep Singh, both by forfeiture and escheat, were set aside by the British Government in favour of the private heir, Rajah Golab Singh,

Singh, to whom the amount was credited as part payment of the purchase of Cashmere," we may confidently anticipate a verdict in our favour, so many technical difficulties in respect to the jurisdiction of the Court, &c., have been raised against us, as to preclude the hope of a speedy decision of the question, and we are therefore reluctantly compelled, unless Her Majesty's Government consent to reconsider our proposal of compromise, and to make such provision for the permanent settlement of the family as may, under the circumstances, appear just and liberal, to ask Her Majesty's Government to continue the State pension for their support.

We have not yet been able to ascertain the exact amount of private property to be divided among the family under the late Rajah's will, but from all that we can learn it is very inconsiderable, and quite inadequate even for the ordinary expenses of a family of very humble rank.

We annex a list of the family of the late Rajah now at Benares, as furnished by the eldest of the illegitimate sons, Chutter Sacker Swamee, who, from the circumstance of the only legitimate son being, it is stated, "next thing to an idiot," is treated as the head of the house.

In the event of Her Majesty's Government not considering it expedient to entertain a compromise of the claims of the family, we would respectfully request that such amount of monthly pension may be placed at the disposal of the Commissioner and Governor General's agent at Benares, for their benefit, as he may consider necessary for their respectable maintenance and support.

List of the family left by the late ex-Rajah of Coorg, at Benares :

- 1 Ranee Nuijammajee.
- 6 concubines.
- 2 father's concubines.
- 2 uncle's concubines.
- 2 illegitimate daughters, viz., Eerma and Gungma.
- 1 legitimate son, Lingray Swamee.
- 6 illegitimate sons, viz. :—
 - Chutter Sacker Swamee.
 - Soon Sacker Swamee.
 - Veer Budder Swamee.
 - Nund Joona Swamee.
 - Moodray Swamee.
 - Puddmin Raj Swamee.

To which are to be added a daughter, the Princess Victoria Gouramma, and two female servants now in England, and a daughter, the wife of the Maharajah Jungh Bahadur, G. C. B., now at Nepal.

T. G. Baring, Esq., to Sir J. Login and R. M. Martin, Esq. ;
dated India Office, 19 May 1860.

I AM directed by the Secretary of State for India to acknowledge the receipt of your letter of the 27th April, and in reply to acquaint you that the Government of India have already been instructed to submit their views with respect to the provision to be made for the maintenance of the family of the late ex-Rajah of Coorg, and that attention will again be called to the subject.

The Governor General of India to Sir *Charles Wood* ; dated Foreign Department, Simla, 30 April (No. 43) 1860.

I HAVE the honour to reply to the several Despatches enumerated in the margin,* regarding the allowances of the family of the late ex-Rajah of Coorg.

2. The ex-Rajah's death makes it unnecessary for me to offer any opinion on the subject of his memorial, but having regard to the sum which was assigned for the support of the Coorg family during his Highness's life (5,000 rupees a month), and to the fact that the family is now reduced in number not only by the Rajah's death

* From Secretary of State, dated 30 June (No. 30) 1859.
From Ditto dated 30 Sept. (No. 46) "
From Ditto dated 7 Oct. (No. 49) "

but by the unfortunate suicide of two other members of it, I think 3,000 rupees a month is a fair but not too liberal an allowance for those who remain in India, and I recommend that this sum be allotted to them henceforward.

3. But I would treat the allowance of the Princess Gouramma as a separate matter. The Princess is a Christian; she can never return to her family in India; the condition in which she is placed in England, and the expenses attendant upon it, are not fully known to the Government of India, and I feel difficulty in saying whether 400 rupees a month is, or is not, a suitable allowance for her in the very peculiar circumstances in which she stands. Much too will depend upon what her future may be. For these reasons, I would suggest to Her Majesty's Government that the provision for her should be settled in England, and that it should be irrespective of what is done in India for the Hindoo members of the family to whom I would allot 3,000 rupees a month.

	Rs.	
For the Ranee - - - - -	600	a month for the members of the Coorg family in
Six Concubines at 50 rupees each - - - - -	300	India, I would recommend that it be distributed
Five Ditto - - - - -	250	amongst them in about the proportion noted in the
The Legitimate Son - - - - -	500	margin,* with the understanding that (except in
Six Illegitimate Sons, 200 rupees each - - - - -	1,200	the case of the concubines, whose stipends will
The Daughter in India - - - - -	150	absolutely lapse at their death), on the lapse of
TOTAL - - - - -	Rs. 3,000	each pension by the death of the recipients, the

Government of India will exercise its judgment as to the continuance of any portion of the sum to any relation or dependent of the deceased.

I have, &c.

(signed) *Canning.*

Enclosures in Governor General's Letter (No. 43) of 1860.

(No. 37.)

From *F. B. Gubbins*, Esq., Superintendent of the ex-Raja of Coorg, to *Cecil Beadon*, Esq., Secretary to the Government of India (Foreign Department) with the Governor General; Dated Camp Mahowl, 16 November 1859.

Sir,

I HAVE the honour to acknowledge the receipt of Mr. Simson's letter (No. 271) of the 7th instant, enclosing a copy of the Will executed by the late ex-Rajah of Coorg in London, on the 24th September last, as well as of a demi-official communication addressed to the Foreign Secretary to the Government of India by Mr. John William Kaye.

2. In reply, I have the honour to state that on the intelligence of the demise of the ex-Rajah of Coorg reaching me on the 30th ultimo by electric telegraph, I thought it my duty at once to put a strong guard over the premises occupied by that nobleman's family.

3. The two elder illegitimate sons happened to be absent on a sporting expedition in the Mirzapoor district, and were immediately summoned into Benares. On their arrival all the brothers were desired to join, and have their late father's treasure dug up from the places in which it had been concealed, and this was commenced upon on the 2d instant.

4. On the 4th instant I received demi-official communications from Mr. Montgomery Martin, one of the executors of the will, and from Mr. John William Kaye, informing me of the dispositions made by the late Rajah.

5. I left Benares on circuit on the 7th instant; but before doing so, I had locked all the valuable property that I could collect into three iron and two wooden chests, which have been carefully sealed up. The chest containing the most valuable portion of the property, such as two gold bricks, women's jewellery, &c., &c., has been moved out into the portico of the house, and a guard put over it.

6. There was, however, no list of the property whereby I could be guided, and it is impossible for me to say whether all the valuables left by the late Rajah have been exhumed or not. The probability is that they have not all of them been exhumed, and it was only by exerting my entire influence, and by threatening one of the illegitimate sons with incarceration, when he began to deny there being any buried treasure, that I got them delivered up at all.

7. I hope to be able to make an inventory of the property when I return to Benares, and I have in the meanwhile left 8,000 rupees in cash with the Ranee Nujjumajee to enable her to meet the current expenses of her household, and to have the funeral obsequies of the two Ranees, Gungamah and Dewa Majee, decently performed.

8. I regret

8. I regret to have to inform you that on the intelligence of the demise of the ex-Rajah of Coorg reaching that nobleman's widows, the Ranee Gungamah, who had been left in charge of his affairs, considered it her duty to commit suicide by swallowing a large dose of opium. On hearing of her illness, I immediately proceeded to the family residence, summoned the civil surgeon, and assisted him in trying to bring her back to consciousness; but the stomach-pumps broke, and the emetics had no effect, and the lady expired in a few hours. I then took every precaution to prevent poison of any sort being introduced into the house, and hoped that no more deaths would have occurred; but I was again summoned there on the 1st instant, by the intelligence that another Ranee was dying.

9. The civil surgeon was again sent for, but the Ranee Dewa Majee had expired before either he or I could reach the house. I thought it then my duty to take stringent measures to prevent the recurrence of such an event, the more so as I learnt that the third and last Ranee, named Nujjumajee, was, with one of the concubines, in a dying state, they having, like the last Ranee, refused to partake of any food since they had heard of the Rajah's death, and I did not quit the house next morning till the civil surgeon (Dr. Cheek) had convinced himself that all the household had eaten their food and were doing well.

10. The family left by the ex-Rajah of Coorg now consists of—

- 1 Ranee, or lawful widow.
- 6 Concubines.
- 3 Of his father's wives or concubines.
- 2 Of his grandfather's ditto, ditto.

There are seven sons whom I had imagined to be all equal and legitimate, but I have now ascertained that there is but one of them, named Lingraj, who is born of a lawful wife. He is, however, unfortunately next thing to an idiot, and speaks with difficulty.

11. Besides the two daughters who are married to Maharajah Jung Bahadoor, and the one who is now in England, I have ascertained the existence of a fourth daughter, named Gungamah, who appears to be about eight or nine years old.

12. I beg, in connexion with this subject, to annex a copy of a communication received from the Officiating Civil Auditor, North West Provinces, and to inform you that the allowance of 5,000 rupees per mensem, made for the support of the Coorg family, has been stopped by that officer, and to solicit His Excellency the Viceroy's orders upon the subject of its continuation or otherwise.

I have, &c.
(signed) *F. B. Gubbins.*

(No. 1115.)

To *F. B. Gubbins, Esq.*, Superintendent of the ex-Rajah of Coorg, Benares.

Sir,

WITH reference to the intelligence by a recent mail of the death of the ex-Rajah in England, I have the honour to request a certificate of the date on which the event occurred, to enable me to audit the accompanying bill for his pension for September last, which is returned for amendment if necessary.

Civil Auditor's Office,
North Western Provinces, Allahabad,
9 November 1859.

I have, &c.
(signed) *J. Eede,*
Officiating Civil Auditor.

(No. 673.)

From the Under Secretary to the Government of India with the Governor General, to *F. B. Gubbins, Esq.*, Superintendent of the ex-Rajah of Coorg, Benares. (Foreign Department.)

Sir,

I HAVE the honour to acknowledge the receipt of your letter (No. 37), dated the 16th ultimo, submitting a Report regarding the family and affairs of the late ex-Rajah of Coorg; and in reply, to communicate to you the Governor General's approval of your proceedings.

2. The suicide of the two Ranees is a subject of much regret to his Excellency.

3. You will receive hereafter the orders of his Excellency regarding the provision which is to be made for the family of the ex-Rajah.

Camp Allygurb,
13 December 1859.

I have, &c.
(signed) *C. U. Aitchison.*

(No. 674.)

From the Under-Secretary to the Government of India with the Governor General, to the Officiating Secretary to Government of India, Calcutta. (Foreign Department).

Sir,

WITH reference to the accompanying copy of a correspondence with the Superintendent of the ex-Rajah of Coorg, I am directed to request that you will be so good as to obtain the opinion of his Honor the President in Council as to the provision which should be made for the family of the ex-Rajah.

Camp Allygurrh,
13 December 1859.

I have, &c.
(signed) C. U. Aitchison.

(No. 39.)

From F. B. Gubbins, Esq., Superintendent of Ex-Rajah Coorg, to Secretary to the Government of India, with the Governor General; dated Benares, 19 December 1859.

Sir,

IN continuation of my letter, No. 37, of the 16th ultimo, and in reply to the last para. of Mr. Aitchison's letter, No. 673, of the 13th instant, I would beg to be again allowed to draw the attention of the Supreme Government of India to the affairs of the family of the late ex-Rajah of Coorg.

2. The money that I had left with the surviving Rancee is stated to have been all of it expended in performing the funeral rights of the late Rajah, and his two widows, and the family clamours for more.

3. I beg, likewise, to annex a copy of a letter received from the late Rajah's Secretary, Mr. Birkett, and to submit that, if the family allowance was once settled, one of the sons might proceed to England for the purpose of bringing back to this country the two native ladies alluded to by Mr. Birkett, and the late Rajah's corpse.

I have, &c.
(signed) Fred. Gubbins.

To Her Royal Highness the Rancee Gunga Majee of Coorg.

7, Gloucester-place, Kentish Town,
London, 24 October 1859.

After compliments,

As Secretary to his Highness the Rajah of Coorg during the whole of his sojourn in England, I deeply regret that it is my painful duty to convey to your Royal Highness the sad intelligence of his death, which event took place on the 24th of September last. On the 29th his remains were temporarily conveyed to Kensal Green Cemetery, and his funeral was conducted with every respect due to his royal rank. The neighbourhood in which he lived showed their regret for his loss by closing of their houses on the mournful occasion, for he lived and died respected by all, and his loss was deeply felt, more especially by the poor to whom he was very charitable and good.

I was daily with him during his long illness, he was attended by the first medical men in the country, and by the Queen's physician. He received every kindness and attention from all about him, especially from his two Indian ladies, his attendants, who never ceased to his last moments to watch over and comfort him day and night. I was at his bedside when he expired; he was sensible to the last. He expressed to me great anxiety about these two ladies being left unprotected after his death, and was sorry that his son was not in England to take charge of them, but hoped he would soon arrive on hearing of it. He desired me to write and beg that your Highness would see to their future wants and comfort, and make a provision for them both during their lifetime out of his pension from Government. He also expressed a wish that his body should not remain in England, but that it might be conveyed to his native country Coorg.

I beg to say that the two Indian ladies intend, in accordance with the wish of his late Highness to remain in England until they hear your wishes and intentions, or till the arrival of the prince, your son, to take charge of his father's remains, when they would like to return with him to India, and that as soon as possible, as they do not wish to continue to live in this country.

I have been, and still am in charge of his Highness's property in the house (his jewels, &c., have been for safe custody locked up, and a list taken of them, and deposited with his bankers) under the authority of his Highness's solicitor and executors, and shall feel obliged by an answer being sent to this letter by a return mail, addressed to me as under.

I have, &c.
(signed) John James Birkett,
Secretary to his late Highness
Veer Rajunder Wadee Rajah of Coorg.

(No. 826.)

From the Under Secretary to the Government of India, with the Governor General, to the Officiating Secretary to the Government of India, Foreign Department, Calcutta.

Sir,

IN continuation of my letter, No. 674, dated 13th instant, I have the honour to forward, for submission to the Honourable the President in Council, copy of a further letter, and of its enclosure, from Mr. Gubbins, regarding the provision for the family of the late ex-Rajah of Coorg.

No. 39, dated 19 December 1859.

Camp Begumabad, 27 December 1859.

I have, &c.
(signed) C. U. Aitchison.

(No. 821.)

From W. Grey, Esq., Officiating Secretary to Government of India, to C. Beadon, Esq., Secretary to Government of India, with the Governor General, dated Fort William, 20 March 1860. (Foreign Department).

Sir,

WITH reference to Mr. Aitchison's letters, dated the 13th and the 27th December, Nos. 674 and 826, I am directed to forward for submission to his Excellency the Governor General, the accompanying copy of a correspondence* with the Governor General's agent at Benares relative to the provision to be made for the members of the Coorg family.

* To Agent, dated 6 Feb., No. 395.
From ditto, dated 25 ditto, No. 62.

2d. It will be observed that the agent has been already authorised to make such allowances to the family in India as he may deem proper, not exceeding 2,000 rupees a month, and the President in Council feels no hesitation in now recommending that the larger amount proposed by the agent should be provisionally sanctioned, pending the orders of the Secretary of State for India on the case.

3d. I am desired to submit copy of a Minute recorded by Sir Bartle Frere, in regard to the manner of the agent's proceedings in this case.

I have, &c.
(signed) W. Grey.

(No. 395.)

From the Officiating Under Secretary to Government of India to the Agent to Governor General, Benares, and Superintendent of the Ex-Rajah of Coorg's family, dated Fort William, 6 February 1860 (Foreign Department).

Sir,

HIS Excellency, the Governor General, having forwarded your letters, marginally noted,† for the opinion of the President in Council, as to the provision which should be made for the family of the deceased ex-Rajah of Coorg, I am directed to state that it appears to his Honour in Council that stipends, somewhat on the following scale, will afford a suitable provision for the surviving members of the family:—

† Dated 16 November 1859, No. 37; 19 December 1859, No. 39.

	Rs.
For the Ranee - - - - -	per mensem 500
For the six concubines at 50 each - - - - -	300
For the five ditto of father and grandfather - - - - -	250
For the legitimate son - - - - -	500
For the daughter in England - - - - -	400
For the six illegitimate sons at 100 each - - - - -	600
For the daughter in India - - - - -	100
Total - - -	Rs. 2,650

2. Before, however, communicating on the subject with the Governor General, the President in Council is desirous to be favoured with your opinion, and it is possible that circumstances may exist, with which you are acquainted, that may render modifications on the above case advisable. It may, for example, be the case, that one or more of the illegitimate sons have been acknowledged as holding a position superior to the others; and adverting to what is mentioned, regarding the mental condition of the legitimate son, it may not possibly seem necessary to make for him so large a provision as that above suggested.

3. I am desired, therefore, to request that you will be good enough to communicate your opinion as to the provision which should be made for the several members of the ex-Rajah's family.

480.

C

4. Pending

4. Pending the final orders of Government, you are authorised to make such allowances as you may consider necessary for the comfort of the family in India, not exceeding in the aggregate 2,000 rupees a month, calculated from the date on which the pension allowed to the late Rajah was stopped. It should, however, be carefully explained to them that the amount to be ultimately allowed, will depend upon the views of his Excellency the Governor General, and of the Home Government.

I have, &c.
(signed) *R. B. Chapman.*

(No. 62 of 1860.)

From *F. B. Gubbins*, Esq., Agent, Governor General, Benares, to *R. B. Chapman*, Esq.,
Officiating Under Secretary to Government of India, Fort William, dated Benares,
25 February 1860.

Sir,

I HAVE the honour to acknowledge the receipt of your letter, No. 395, dated the 6th instant, relative to the allowances proposed to be made to the several members of the Coorg family, subsequently to the demise of the late Rajah.

2. In reply, I beg to submit that I do not consider the sum of 100 rupees per mensem as in any way an adequate allowance for the several illegitimate sons of this family.

3. The fact is, that the customs of the Coorg country differ very much from those of this part of India, and from our own. The ladies of the late Rajah's zenana, whom we style concubines, are with them called ranees, and occupy a position but little inferior to the real ranees, and I have been told that of two sisters, one was a ranee, and the other a concubine.

4. The offspring of these ladies have likewise been always regarded in almost exactly the same light as the one legitimate son, and the elder brother, Chauter Sheekur, who is illegitimate, has invariably acted and been received as the head of the male portion of the family during his father's absence.

5. The executors of the late Rajah's will, Sir J. Login and Mr. Montgomery Martin, inform me that they have every hope of their being able to compromise the suit laid against the Government, for a perpetual commutation of the former allowance of 5,000 rupees per mensem; and I would therefore respectfully solicit that the present proposed allowance be raised (as a temporary measure) from 2,600 to 3,000 rupees a month, and that the distribution of this sum be (with the exception of the Princess Gouramma's stipend of 400 rupees) left to the Agent to the Governor General at Benares.

6. Should this proposal be acceded to, I shall, no doubt, be able to keep my portion of the family contented on their monthly allowance of 2,600 rupees.

7. As the family stipend has, however, been retrenched by the civil auditors since the date of the late Rajah's demise, I would solicit the favour of an early decision being come to on this subject by Government, and of a retrospective effect being given thereto, so as to enable the family to draw their back pay.

I have, &c.
(signed) *F. B. Gubbins.*

MINUTE by the Honourable Sir *Bartle Frere*, dated 5 March 1860.

I do not think that under any circumstances we can go wrong in sanctioning the arrangement proposed by the Governor General's Agent, at least till we receive the orders of the Secretary of State. I think we should treat this family with the utmost liberality consistent with justice to other parties, and I do not feel satisfied, from the tone of Mr. Gubbins's letters, that they will meet at his hands with the consideration which is, I think, due to them. I have no doubt it was impossible to prevent the suicide of the two ranees, and it may have been necessary to have "threatened with incarceration" the son who seems not to have been aware that it was the agent's duty to have his father's property dug up and put under lock and key; but the former event should have been reported otherwise than by an incidental and somewhat flippant notice in a letter on another subject written a fortnight after the event; and after attaching all the valuables he could find, the agent was, I think, bound to make better provision for the daily wants of the family than by reporting, some six weeks afterwards, that the "family clamours for more."

Setting aside all higher considerations, it should be remembered that any want of consideration shown to this family at Benares, will speedily be repeated, with natural exaggerations, in every native court in India; and that though the justice of our proceedings in going to war with, and deposing the late Rajah has never, I believe, been questioned by competent judges, opinions are by no means so unanimous regarding our later proceedings since he has been our prisoner.

I should,

N.B.—It is proposed to allow the daughter in England *Rs.* 400 a month, and as she is quite as illegitimate as the six brothers, it would appear harsh to give her four times as much as is given to them.

I should, at any rate, wish my remarks, regarding the agent's treatment of the family, to be submitted to his Excellency the Governor General, and to the Secretary of State. I would fain hope that any want of consideration extended no farther than the agent's manner of expressing himself in his official report; but it is precisely such mistakes of manner which form the sting to such acts of disagreeable duty as it fell to the agent to discharge; and unless I am entirely mistaken in the view I have expressed, any notice of the matter by his Excellency will have a beneficial effect.

It is difficult for any one who does not personally know the race, to understand how utterly different they are from us, and even from most Indian races in all their motives and modes of action; but there is much, even in these few papers, to illustrate the wideness of the gulf which separates us, and the difficulty of judging of them by European standards.

(signed) *H. B. E. Frere.*

P.S.—I think it would be well to call for a return of the revenue and expenditure on account of Coorg since its annexation. Has it paid its expenses?

H. B. E. F.

MINUTE by his Excellency the Viceroy and Governor General of India, dated Camp Hoohyarpore, the 30th March 1860.

I THINK that, having regard to the sum which was assigned for the support of the Coorg family during the Rajah's life (5,000 rupees a month), and to the fact that the family is now reduced in number, not only by the Rajah's death, but by the unfortunate suicide of two other members of it, 3,000 rupees a month is a fair, but not too liberal an allowance for those who remain in India. I recommend that this sum be allotted to them henceforward.

Family of the late Rajah of Coorg.

But I would treat the allowance of the Princess Gouramma as a separate matter.

The princess is a Christian; she can never return to her family in India; the condition in which she is placed in England, and the expenses attendant upon it, are not fully known to the Government of India; and I feel difficulty in saying whether 400 rupees a month is, or is not, a suitable allowance for her in the very peculiar circumstances in which she stands.

Much, too, will depend upon what her future may be.

For these reasons, I would suggest to Her Majesty's Government that the provision for her should be settled in England, and that it should be irrespective of what is done in India for the Hindoo members of the family, to whom I would allot 3,000 rupees a month.

I do not think that Mr. Gubbins is to be blamed for what he did or wrote in the first of his communications. I was not surprised to hear that the son of the Rajah put obstructions in the way of collecting his father's valuables, and that nothing short of the threat of severe measures against himself obtained his co-operation. I think, too, that Mr. Gubbins gave practical proof of his consideration for the family in urging a larger allowance than was at first proposed for them.

But I cannot absolve Mr. Gubbins of flippancy in speaking of the family as "clamouring for more," in the circumstances of uncertainty and difficulty in which they were placed. I believe, however, that there has not been any want of consideration on Mr. Gubbins' part in his dealings with the family at any time, although his tone in writing to the Government about their affairs is, in this instance, open to objection. My reasons for this belief is, that I know very few officers indeed who have secured the confidence and respect of the native chiefs and gentry with whom they have been brought into contact, so thoroughly as Mr. Gubbins.

Those who were faithful, and those who were of doubtful fidelity (and some of both kinds came under his authority at Benares in the mutiny), have always spoken of him with the highest respect, and in some cases with gratitude. In more than one notable instance he encouraged and confirmed their loyalty by his kindness as much as by his firmness. It will, I am sure, be sufficient if Mr. Gubbins' attention is directed to the unsuitableness of that language to which I have alluded.

If Her Majesty's Government should sanction an allowance of 3,000 rupees a month for the members of the Coorg family in India, I would recommend that it be distributed amongst them in about the proportion suggested by Mr. Gubbins, with the understanding that, on the lapse of each pension by the death of the recipient, the Government of India will exercise its judgment as to the continuance of any portion of the sum to any relation or dependent of the deceased.

(signed) *Canning.*

(No. 1112.)

From the Secretary to the Government of India, with the Governor General, to the Agent to the Governor General at Benares, dated Camp, Hoohyarpore, 30 March 1860 (Foreign Department).

Sir,

IN continuation of Mr. Aitchison's letter, No. 673, dated the 13th December last, and with reference to your subsequent letters, No. 39, dated the 19th December, and No. 62, dated the 25th February last, I am directed to inform you that the Governor General has

been pleased to sanction, subject to the approval of Her Majesty's Government, an allowance of 3,000 rupees a month for the family of the late Rajah of Coorg, who remain in India, payable from the date on which the allowance of 5,000 rupees a month, granted for the maintenance of the family during the life-time of the Rajah, ceased.

2. This sum will be distributed as follows:—

	<i>Rs.</i>
For the Ranee - - - - -	per month 600
Six concubines at 50 rupees - - - - -	„ 300
Five ditto at 50 rupees - - - - -	„ 250
For the legitimate son - - - - -	„ 500
For the six illegitimate sons at 200 rupees - - - - -	„ 1,200
For the daughter in India - - - - -	„ 150
TOTAL, per month - - -	<i>Rs.</i> 3,000

The allowance of each member of the family is to be considered as for life, but (except in the case of the concubines) with the understanding that on the lapse of each pension by the death of the recipient, the Government of India will exercise its judgment as to the continuance of any portion of the sum to any relative or dependent of the deceased.

3. Provision will be made by Her Majesty's Government (independent of the above allowance) for a suitable maintenance for the Princess Gouramma, the daughter of the late Rajah, now in England.

4. I am directed by the Governor General to caution you against the use of such language in reference to a case of this kind, as that the "family clamours for more." A flippant expression of this kind is unfitted for official correspondence, and may not unreasonably give rise to the supposition, that the members of the Coorg family will not receive at your hands the consideration which their rank and circumstances deserve, a supposition which the Governor General gladly acknowledges would be quite at variance with the confidence and respect with which you have inspired the native chiefs and gentry with whom you have been brought in contact.

I have, &c.,
(signed) *C. Beadon.*

(No. 1103.)

From Lord *H. U. Browne*, Officiating Under Secretary to the Government of India, to *C. Beadon*, Esq., Secretary to the Government of India, with the Governor General, dated Fort William, 20 April 1860 (Foreign Department).

Sir,

I HAVE the honour to acknowledge the receipt of your letter dated the 30th ultimo, No. 1114, forwarding copy of a Minute recorded by the Governor General, relative to the maintenance of the Coorg family.

2. With reference to the remarks relating to Mr. Gubbins, I am directed by the President in Council to transmit to you, for submission to his Excellency, the accompanying copy of a Minute recorded by the Honourable Sir Bartle Frere, on the 13th instant.

I have, &c.,
(signed) *H. Ulick Browne.*

MINUTE by the Honourable Sir *H. B. E. Frere*, dated 13 April 1860.

I AM glad to accept his Excellency the Governor General's opinion of Mr. Gubbins, as conclusive evidence that the apprehensions I expressed were groundless. I had not any previous official knowledge of his mode of dealing with natives of rank, and judged solely from these papers. I should wish the note to be dealt with as my previous note was.

(signed) *H. B. E. Frere.*

POLITICAL DEPARTMENT.

EXTRACT Despatch, Sir *Charles Wood* to the Governor General of India, dated 16 August (No. 63), 1860.

Governor General's Letter, dated 30 April (No. 43), 1860. Proposed provision for the family of the late ex-Rajah of Coorg.

6. In this letter your Excellency recommends that the allowance of 5,000 rupees a month, granted to the ex-Rajah of Coorg, should, in consequence of his death, and the suicide of two of his wives, be reduced to 3,000 rupees. With respect to the Princess Gouramma, you suggest that a separate provision should be made for her in England, altogether irrespectively of any arrangements

ments that may be made in India for the maintenance of the rest of the family.

7. Her Majesty's Government approve of the proposed arrangement for the support of the widows and children of the ex-Rajah, and of the distribution suggested in the fourth paragraph of your letter. Separate provision has already been made for the Princess Gouramma, who is in the enjoyment of an allowance of 1,000 *l.* per annum, payable at the Treasury of the India Office.

Sir *J. S. Login* and *R. M. Martin, Esq.*, to the Under Secretary of State for India.

17 May 1861.

IN forwarding, for submission to the Right Honourable the Secretary of State for India in Council, the accompanying copy of a letter and memorial which we have addressed to the Lords Commissioners of Her Majesty's Treasury, in behalf of the family of the late ex-Rajah of Coorg, we would respectfully request their favourable consideration to the prayer of our petition, as affording a most desirable opportunity of making a permanent provision for the Coorg family, in a manner equally in accordance with their recent policy towards other State pensioners; creditable to their justice and generosity; beneficial to a distinguished family, whose circumstances demand their sympathy, and *satisfactory to the public faith.*

As the advantages which the Government of India have already derived from the annexation of the Coorg territories, preclude the idea of depriving the family of the small pensions which they now receive (amounting in all, it is believed, to 4,000 *l.* per annum), and as the total amount accruing from the debt will barely suffice to place a family, accustomed, like all State pensioners in India, to a life of indolence and self-indulgence, in a position to make provision for their descendants, we venture very respectfully to suggest, that a portion of the sum which may be granted to them, may be appropriated to the insurance of the lives of individual pensioners, for the benefit of their families, so as gradually to introduce them to habits of prudent economy, and prevent them from continuing to be dependent encumbrances on the finances of the State.

To the Right Honourable the Lords Commissioners of Her Majesty's Treasury.

May it please Your Lordships,

IN submitting the accompanying memorial, we would briefly express its object, and very humbly and respectfully solicit your Lordships' favourable consideration to it.

By the judgment of his Honour the Master of the Rolls, in the case of *Rajah Veer Rajinder Waddeer v. the East India Company*, a large sum of money arising from a *debt* due by the East India Company, to the late ex-Rajah of Coorg, having been placed at the disposal of the Crown, under circumstances which still leave much doubt as to the *propriety* of considering it in the light of booty taken in war, we, as executors under the late Rajah's will, consider it our duty to petition your Lordships, that the same may be appropriated to the benefit of the family of the deceased Rajah, who, through a single act of ignorant and presumptuous folly, which has been punished in a manner more in accordance with oriental precedents than with the practice among European nations, have forfeited their position among Indian princes, been deprived of all the benefits which they should have inherited from the loyal fidelity of their ancestors towards the British Government in India, and been placed in a position of precarious dependence on their bounty.

That the claims of the family, on account of loyal services, were of no ordinary character, is shown by the extracts appended to the memorial, from the published despatches of the Marquis Wellesley, the late Duke of Wellington, and the declaration made by Lieutenant General Sir Robert Abercromby, Commander in Chief of the Bombay Army, in the war against Tippoo Sultaun; which also serve to show the manner in which the Rajahs of Coorg were enabled to accu-

multate private wealth, to a considerable amount, and to advance money on loan to the East India Company, when they held the sovereignty of their territories.

We would also very respectfully request the consideration of your Lordships to the fact, that, irrespective of the promissory notes of the Government of India, with interest accruing thereon, amounting in all to about 200,000*l.*, which have up to this time been retained by the Government of India, but are now shown to be at the disposal of the Crown, the Indian Government have already derived great financial and political advantages from the annexation of the Coorg territories to their dominions; seeing that in return for the expenses of a very short and comparatively bloodless campaign, the charges incurred in removing the ex-Rajah and his family to Benares, and the payment of an annuity of 6,000*l.*, since 1834, they have received a moiety of the booty taken at the capture of Coorg (amounting to 160,000*l.*), appropriated its yearly revenues, estimated at 20,000*l.* per annum, and have obtained possession of a tract of country of much geographical and strategical importance, and very favorably situated for the location of European colonists.

Under these circumstances we venture to hope that your Lordships will be graciously pleased to comply with the prayer of the petition, and to appropriate the amount at your disposal to the benefit of the family, in such manner as to your Lordships may appear best.

We have, &c.

(signed) *J. S. Login,*
R. M. Martin,

Executors under the Will of the late
Ex-Rajah of Coorg.

London, 17 May 1861.

To the Right Honourable the Lords Commissioners of Her Majesty's Treasury.

THE humble Memorial of *Sir John Spencer Login*, of Upper Hyde Park-gardens, Bayswater, in the county of Middlesex, Knight, and *Robert Montgomery Martin*, of Eden Villa, Worthing, in the County of Sussex, Esquire, the Executors of the late *Veer Rajinder Waddeer*, a Hindoo, deceased, and formerly Rajah and Sovereign of the Principality or State of Coorg, in the South-west of British India.

Shew,

THAT in the year 1854, the above-named *Veer Rajinder Waddeer*, then ex-Rajah of Coorg, and residing in England, claiming to be a creditor holding public stock of the Indian Government, being part of their funded debt secured by the public revenues, commenced, after a conference as to the steps necessary to be taken, with the Secretary of the Honourable East India Company (*Sir J. C. Melvill*), a suit in the Court of Chancery against the East India Company, to determine the right to two promissory notes of their Indian Government, commonly called Company's paper, together with arrears of interest thereon; that the one was a note to secure the sum of 653,940 Madras rupees, with interest at six per cent., standing in the name of *Dayoo Amahjy*, the daughter of his uncle, formerly Rajah of Coorg, both long since deceased; and that the other was to secure 203,900 sicca rupees, with interest at four per cent., which was made payable to, and stood, and still stands in the name of the plaintiff himself, his executors and administrators, or his or their order. See Appendix (A.), I. and II.

That in the bill of complaint filed in such suit, it was, amongst other things, stated that the interest on the said last-mentioned sums respectively had been paid by the East India Company to the plaintiff, from the year 1817, when he succeeded to the same, and to the raj or sovereignty of Coorg, on the death of his late father, who was the immediate successor of his said uncle, down to the year 1833.

That in 1834 the Government of India, without any adequate cause to justify such act of violence, invaded and took possession of the plaintiff's principality, subjected and confiscated the plaintiff's treasury and other property there, to the value of 160,000*l.* by means of a military force, and removed him as a prisoner of war to Benares, where he was detained for 18 years, until permitted by the Indian Government to visit England, with the view of having his daughter baptised and educated in the Christian faith.

That the surplus revenue of Coorg was then upwards of 20,000*l.* annually, and that the same had since much increased for the benefit of the defendants; and that the treasure and property so seized was confiscated and distributed as booty between the defendants and the troops; but that the said promissory notes and the moneys in the public funds represented thereby were considered and treated, upon principles of public policy and the law of nations, as exempt from seizure and confiscation, and were set apart, and kept, retained, and dealt with, by the defendants and their government and agents in India, as property held by them on deposit or trust; and that the said securities had, from time to time, been brought forward

forward in the public books of the defendants as subsisting charges on the revenues of the defendants.

That the East India Company, by their answer filed in the said suit, stated, by way of defence (amongst other things) to the purport and effect that the only claim of title of the plaintiff to the said promissory notes was as Rajah of Coorg; that the British Government in India, in 1834, declared war against him, entered his territories with an armed force, conquered his country (which up to that time had been in friendly alliance with the British Government), annexed Coorg to the British territories, and made the plaintiff a prisoner of war.

That the East India Company also, by their answer, charged and contended by way of defence to the said suit, that the dominions of the plaintiff, with all the property belonging to him, except only property to the value of 1,000 l. which he was permitted to retain, passed to the British Government in India by right of conquest; and that, with the exception before-mentioned, all his property, including therein the said two promissory notes which they the defendants have caused to be taken possession of by their servants or agents, were by an act of sovereign and political power of the Government of India, forfeited and transferred to such Government; and that, accordingly, the British Government in India afterwards paid no interest on the said two notes; and that, although the registry of the said securities was not immediately cancelled, the only reason was that the British Government in India did not desire to prejudice, under the circumstances, such fair or equitable claims (if any) as could be brought forward respecting the same by any other person than the plaintiff; and it was urged and contended by the answer, that all the acts therein stated to have been done by the British Government in India, were done by the Government of the defendants the East India Company, acting in their political and sovereign character; and it was then submitted by the answer, as matter of law to the judgment of the Court, as a bar to the plaintiff's suit, that the plaintiff could not sustain any suit in any municipal court in respect of matters arising out of such acts. And by the said answer it was admitted that the defendant's Government in India seized and confiscated the treasure and all the other property of plaintiff taken at Coorg, and distributed the same as captured prize booty, under a warrant of his late Majesty King William the Fourth; and that such warrant granted the same to them (the East India Company), in trust, as to one moiety for the Government of India, and as to the other moiety in trust for the troops employed in the Coorg war, and that the same was divided accordingly; but it was denied by the answer that the moneys claimed by the plaintiff in the defendant's public funds, and secured by the said two notes, were considered and treated by the defendants and the Indian Government as exempt from seizure and confiscation, upon principles of public policy, or that the same had not been seized and confiscated; but it was at the same time admitted by the answer that the fact was that the said last-mentioned moneys were not at any time dealt with or distributed as the treasure and other property of the plaintiff had been as aforesaid; but the answer denied the reason stated in the bill of complaint, viz., that the said two notes, and the moneys secured thereby, were not prize or booty.

That the plaintiff died while the suit was pending, and that after two ineffectual attempts at compromise, the same was revived by your memorialists as such executors as aforesaid, under an express authority in that behalf given to them by the will of the plaintiff. See Appendix (B.)

That the suit was heard by his Honor the Master of the Rolls, on the 12th and 13th of November 1860, by counsel (noted in the margin), when his Honor was pleased to reserve judgment.

That judgment was delivered by his Honor on the 8th December 1860, when it was (amongst other things) declared and decreed, to the purport and effect following:—That, early in 1834, differences arose between the East Indian Government and the plaintiff; that the former made war against the latter, and that Coorg was taken in April 1834, annexed to the British territory in India, and the plaintiff made a prisoner, and that he practically remained such during his life, although in 1850 permitted to visit this country, where he commenced his suit in 1854; that his property was divided as booty of war, but that neither of the two notes in question was included in the division and distribution; that the defence is, that this court has no jurisdiction to entertain the question; that this is the case of a captive prince taken by a hostile power in war, and in the exercise of its political power, and in its character of a sovereign power, and that if such was a correct description of the transaction, undoubtedly it was not cognizable by any court of justice; that (in the opinion of his Honor), the two promissory notes were held by the plaintiff in his character of Rajah, as part of the *jura regalia* of Coorg. The judgment and decree then further declared and decreed that these two notes were taken possession of by the servants and agents of the defendants, and under circumstances which amounted to a taking possession by the defendants in the exercise of sovereign and political power; and that these acts, therefore, were not subject to the control of the court; and that the Bill of the plaintiff should be therefore (and it was accordingly) dismissed, *but without costs*.

That a copy of this judgment is annexed hereto, and marked as Appendix (C.)

That the warrant of his late Majesty King William the Fourth, mentioned as above in the defendant's answer, bears date the 6th day of June 1835, and recites (amongst other things) the particulars of certain property of the ex-Rajah to the value of 14,96,735 rupees, which, together with the fortress of Coorg, had been reported to the Lords Commissioners of his Majesty's Treasury as captured by the troops of his Majesty, acting in concert with the troops of the East India Company; and that their Lordships had represented unto his Majesty that the same being booty did of right belong to his Majesty in virtue of his

For the plaintiff,
Mr. Roundell Palmer, Q. C., Mr. J. F. Leith, Mr. Schomberg.

For the Defendants,
the Attorney General, Mr. Lloyd, Q. C., Mr. Forsyth, Q. C., Mr. W. H. Melville.

his Royal prerogative, and that the same should be given and granted in such manner as to his Majesty should seem meet and just; and that a memorial had been addressed to the said Lords Commissioners, on the part and behalf of the East India Company and of the captors, praying that his Majesty would be graciously pleased to grant to the said Company the said booty specially mentioned as above, as to one-half part of the value thereof, for the proper use of the said Company, and as to the other half part for the use of the troops employed in the hostilities; and that the said Lords Commissioners had recommended unto his Majesty to accede to the said prayer, and that his Majesty had been graciously pleased to do so; and his said late Majesty did accordingly, in and by his Majesty's said warrant, give and grant the said portion of the Coorg booty and plunder, in terms of the said prayer, as will appear at large by referring to a copy of the said Royal Warrant, annexed hereto as Appendix (D).

That neither the said two promissory notes nor the moneys (principal or interest) secured thereby were included in the property referred to and granted by the said Royal Warrant; and that no report of such additional booty has ever been made either to his late, or to Her present Majesty; and that, consequently, and in fact, no grant thereof has yet been made.

That the same, according to the answer of the East India Company and the judgment and decree of the Master of the Rolls, belonged to the Rajah of Coorg, and that the same did, therefore, on the hostile seizure of Coorg by the united troops, become forfeited and transferred as booty of war and by right of conquest, together with the first-mentioned portion of his property, to the British Government in India.

That, therefore, *ipso facto*, the said two notes, and the principal and interest secured thereby (including the large arrears of interest accrued thereon since 1833), and all the right, title and interest of the Rajah of Coorg therein, respectively, as a creditor of the East India Company, became vested in his late Majesty, and are now vested in Her present Majesty, to be given and granted as to Her Majesty shall seem meet and just as booty of war, in virtue of the Royal prerogative, according to the declaration in that behalf, respecting the first portion of the Coorg booty, made by his late Majesty in his said Royal Warrant.

That the said East India Company, as the debtors named in the said two promissory notes, were formerly, and the Right Honourable the Secretary of State in Council of India, under the Statute 21st and 22d of Vict. c. 106, is now, an accounting party to Her Majesty in respect of so much of the revenues of India as are chargeable with and liable for the payment of the moneys (principal and interest) aforesaid, secured in and by the said two notes.

That your memorialists, as the executors of the ex-Rajah of Coorg deceased, deem it their duty to bring the above facts to the knowledge of the Lords Commissioners of Her Majesty's Treasury, and at the same time humbly solicit the Lords Commissioners to advise Her Majesty graciously to grant to your memorialists, for the use and benefit of his family, the notes and moneys aforesaid, or some portion thereof; and as reasons for their Lordships so doing, your memorialists crave leave to bring to their Lordships' notice and consideration the additional facts following:—

That it is matter of history that the political and friendly alliance and active co-operation of the Rajahs of Coorg, first secured by a treaty in 1790, with the late uncle of the ex-Rajah, have been of the greatest importance and value to the British Government in India during hostilities with the Government of Mysore; and in particular in assisting with his troops and provisions, in the defeat of Tippoo Sultaun in the wars of 1791 and 1799, which led to the cession of half his dominions to the East India Company.

That extracts from the Wellesley and Wellington Despatches, and from the correspondence of Lieutenant General Sir R. Abercromby, respecting the Coorg family are annexed hereto, and marked as Appendix (E.), Nos. I. and IV.

That the alliance and friendship thus auspiciously begun, continued not only during the remainder of the life of the uncle, but also during that of his successor (in the Raj of Coorg) his brother, who was the father of the ex-rajah; and also during many years of the latter's reign, namely from 1821 up to the year 1833.

That the differences and disputes which then arose between the ex-Rajah and the Government of the East India Company, and led to war, involved questions of public law only.

That the ex-Rajah had made repeated respectful demands to the Government of the East India Company for the delivery up (in order to be brought to trial) of one of his subjects, a murderer, who had fled into their territories. His demands were not acceded to, contrary, as it is submitted, to the principles laid down by a great writer on international law, Vattel, *see* Book ii., c. 6, sect. 75, as well as to the customary practice established between the Government of the Rajah and that of the East India Company. *Vide* Wellington Supplementary Despatches, vol. iii, p. 195.

That the ex-Rajah, acting in the belief that, as a sovereign ruler, he was bound to assert his rights, and to act according to what he believed to be the principles of the law of nations, ordered a native servant of one of the members of the Madras Council to be seized in Coorg, and detained until the Coorg criminal was delivered up.

That this act of the ex-Rajah, and his subsequent refusal to deliver up the servant unconditionally, as demanded by the Government of the East India Company, were the sole causes of the declaration of war by the latter in 1834; and which was immediately followed by the dethronement of the ex-Rajah and the annexation of his country to the

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East India Company's territories; and the Rajah was thereafter detained as a prisoner of war.

That the net surplus revenue of Coorg, after providing for all charges, and the expenses of administration, was about 200,000 rupees annually; and that it is understood that the surplus revenue subsequently increased largely, and has been carried into the public treasury of the East India Company for the general purposes of the British Indian Government.

That the East India Company only allowed the ex-Rajah a pension of 60,000 rupees, or 6,000*l.* per annum, for the support of himself and his numerous family, and his retainers and dependants, who accompanied him from Coorg to Benares, where he was kept and detained.

That the ex-Rajah's conduct during the long period which elapsed from his dethronement in 1832 to his death in 1859, was most excellent and praiseworthy; and that, notwithstanding his great misfortunes, he exhibited at all times respect and attachment to the British Crown. See Appendix (F.), Nos. I. to III.

That his immediate family, exclusive of the numerous retainers attached to the household of a native prince, consisted, at the time of his death, of three Ranees, seven sons, and three daughters.

That the sons reside at Benares with the late Rajah's principal wife, and are entirely dependent upon the very small life-pensions which are granted to them by the Government of India for their support and that of their families.

That of the three daughters, one, the Princess Victoria Gouramma, of Coorg, was brought to England as a child by the ex-Rajah in 1851, and at his request and under his sanction was baptized according to the rites of the Church of England, Her Majesty the Queen having graciously condescended to become sponsor for the child; and the Princess has since been brought up and educated in England in the Christian faith, and in all respects as an English lady, and is now the wife of Lieutenant Colonel John Campbell, late of the East India Company's Service, and that considering her title, position, and rank, and acquired habits from residing in this country, she requires considerably more for her proper maintenance than the other members of her family; while by Hindoo law (which, according to the direction in his will, must govern the distribution of the small savings which, by strict economy, the ex-Rajah was able to leave), she, in common with his other daughters, will be excluded, as your memorialists are advised, from all participation in such savings.

That the second daughter is the wife of his Excellency Jungh Bahadur, G.C.B., the distinguished Minister of Nepaul; and that the third is also said to be residing at the Nepaulese court with her sister.

That your memorialists would humbly entreat the Lords Commissioners to take under their especial care the interests of these persons, the remaining members of the Royal Family of Coorg, towards whom a legitimate sympathy may be felt in their misfortunes, and in their present uncertain pecuniary condition and circumstances; and more especially when it is considered that they are the descendants, or immediate connexions, of the Rajahs of Coorg, to whose friendship and alliance the British Government in India were largely indebted at a very critical period of their history, when their position in that country was endangered by the ambition and treachery of their great enemy Tippoo Sooltan, in the important Mysore wars, as above mentioned.

That your memorialists are the more inclined to hope for a just and liberal consideration of the claims of the Coorg family, by reason of the great generosity lately shown by the Government of India towards Prince Golaum Mahommed and the numerous descendants of Tippoo Sooltan. It will be remembered that the descendants of Tippoo Sooltan have had, since 1799, princely pensions, and have had lately made to them (in 1860), by the Government of India, a large and liberal grant out of the revenues of India to render them independent, and to release them from any longer suffering from the admitted degrading influences of continuing pensioners on the State.

That, in now humbly pressing on the attention of their Lordships the several members of the ex-Rajah's family as proper and fitting objects for the bounty of Her Majesty when granting the above booty, your memorialists would beg to draw their Lordships' special consideration to the peculiar position of the family, and to the nature of the subject in this case, seized or taken possession of as booty by the East India Company, and to their equivocal and questionable act in seizing and treating such a subject at all as booty.

That the subject was a DEBT—stock in the public funds—a portion of their own public funded DEBT, which was created by a former Rajah of Coorg advancing and paying out of his own funds, by way of loan, to the East India Company, as the Governors of India, according to their state and commercial exigencies and requirements from time to time, SUMS OF MONEY WHICH WERE SO LENT IN ABSOLUTE CONFIDENCE AND TRUST IN THEIR PUBLIC FAITH.

That your memorialists submit that among nations who respect and observe the rules of international law, stock in the public funds is respected as a sacred deposit, kept under the guarantee of the national faith, and is not allowed to be affected by war; and therefore if, through policy, the payment of the interest should be suspended during hostilities, the right to the interest revives when these hostilities cease, and is claimable along with the principal.

That the following extracts from Vattel clearly demonstrate the above principle of international law:—

“Everything that belongs to the nation is subject to reprisals, whenever it can be seized, *provided it be not a deposit intrusted to the public faith*. As it is only in consequence of that confidence which the proprietor has placed in our good faith that we happen to have such deposit in our hands, it ought to be respected even in case of open war. Such is the conduct observed in France, England, and elsewhere, with respect to money which foreigners have placed in the public faith.”—(Vattel’s Law of Nations, Book ii., chap. 18, sect. 344). “The State does not so much as touch *the sums which it owes to the enemy*. Money lent to the public is everywhere exempt from confiscation and seizure in case of war.”—(*Ibid*, Book iii., chap. 5, sec. 77, page 323).

See also Emerigon, vol. i., p. 567; and Martin’s Law of Nations, p. 277.

That the hostilities in this case closed with the capture of Coorg, and were not again renewed; and the annexation of the country to the territories of the East India Company, and the consequent transformation of the people into British subjects, immediately followed.

That your memorialists humbly submit that the late ex-Rajah was severely punished for his errors and mistakes, whatever they may have been, by a long exile from his country—deprived of throne, rank, property, and liberty; and they humbly hope that the consideration of this, as well as the consideration of his patient endurance of misfortunes, his praiseworthy conduct during his exile, always showing respect for and attachment to the British Crown, the eminent services and friendly alliance of the Rajahs of Coorg (up to the time when the disputes on questions of public law arose, and led to hostilities with the last Rajah), acknowledged both by the Duke of Wellington and Marquis of Wellesley, and also the now dependent and unfortunate position of his blameless and innocent family (being all that remains of the Royal Family of Coorg), will induce the Lords Commissioners of Her Majesty’s Treasury to take a favourable view of the present application of your memorialists.

See the Wellesley Despatches and the Wellington Despatches.

And your memorialists humbly pray that the Lords Commissioners of Her Majesty’s Treasury will be pleased to advise Her Majesty to graciously give and grant to your memorialists, as such executors as aforesaid, for the use and benefit of all the several members of the ex-Rajah’s family now alive, or to the said members themselves personally, for their adequate and permanent support, and so and in such manner as to render them independent, and not merely Government pensioners, so that they may become useful and honourable members of society, and in such shares and proportions as to Her Majesty shall seem right, the said additional booty—viz., the said two promissory notes and the moneys, both principal and interest, including arrears of interest, secured thereby, now due and hereafter to become due thereon, or such part or parts thereof, respectively, as to Her Majesty shall seem right. Or that the said Lords Commissioners will be pleased to advise Her Majesty to refer, under Section 4 of Statute 3 & 4 Will. 4, c. 41, the matters aforesaid, or such of them as Her Majesty shall think fit, to the Judicial Committee of Her Majesty’s Privy Council for hearing or consideration, and so that such Committee may advise Her Majesty thereon.

And your memorialists shall ever pray, &c.

(signed) J. S. Login,
R. M. Martin.

APPENDIX (A.)

FORM OF PROMISSORY NOTES.

Fort William, 1 May 1832.

No. I.—PROMISSORY NOTE, at four per cent., for 203,900 Calcutta sicca rupees. Registered at the Accountant General’s Office, No. 1733 of 1832-33.

(signed) J. Alexander,
Accountant General.

The Governor General in Council does hereby acknowledge to have received from Veer Rajundur Wadeer, Rajah of Coorg, the sum of 203,900 Calcutta sicca rupees, as a loan to the Honourable the United Company of Merchants of England trading to the East Indies, and does hereby promise, for and on behalf of the said United Company, to repay the said loan, by paying the said sum of 203,900 sicca rupees to Veer Rajundur Wadeer of Coorg, his executors or administrators, or his or their order, on demand, at the General Treasury at Fort William, after the expiration of three months’ notice of payment to be given by the Governor General in Council, in the Government Gazette, and to pay the interest accruing on the said sum of 203,900 sicca rupees, at the rate of four per cent. per annum, by half-yearly payments, at the General Treasury of Fort William, to the said Veer Rajundur Wadeer, Rajah of Coorg, his executors or administrators, or his or their order, until the expiration of three months after such notice of payment aforesaid, when the amount

of

of interest will be payable with the principal; and such notice being considered as equivalent to a tender of payment, at the period appointed for the discharge of this note all further interest shall cease. The Governor General in Council hereby further engages that the said loan shall not be paid off before the 1st of May 1834.

(signed) By the authority of the Governor General in Council,
H. T. Prinsep, Secretary to the Government.

Received in cash the 12 months' interest due on this note, from 1st May 1832 to the 1st May 1833, sicca rupees 8,156.

Appendix No. 2 is a copy of No. 1, granted by the Governor in Council of Madras, in the name of Rajah Ling Rajundur Wadeer.

No. II.—PROMISSORY NOTE for 653,940 Madras Rupees.

Fort St. George, 1 February 1811.

THE Right Honourable the Governor in Council does hereby acknowledge to have received from her Highness Dayoo Amahjy, Rane of Coorg, the sum of 653,940 Madras rupees, as a loan to the Honourable United Company of Merchants of England trading to the East Indies, and does hereby promise, for and on behalf of the said United Company, to repay and discharge the said loan, by paying unto the said her Highness Dayoo Amahjy, Rane of Coorg, her executors or administrators, or her or their order, the principal sum of 653,940 Madras rupees aforesaid, at the Presidency of Fort St. George, agreeably to the order in which this note may stand on the Register of Notes and Bonds of this Presidency, payable according to priority of date and number, according to the condition of the advertisement published in the Madras Government Gazette of the 2d December 1809, and by paying the interest accruing thereon, at the rate of six per cent. per annum, from the day of the date hereof, by half-yearly payments, from year to year, in cash, at the General Treasury at the Presidency, until the principal shall be discharged.

Accountant General's Office. Registered as No. 65 of 1828 and 1829.

(signed) F. F. Clementson,
Deputy Accountant General.

(signed) By the authority of the Right Honourable the Governor in Council,
R. Clive, Chief Secretary to Government.

I do hereby certify that the within is a registered promissory note, and that interest has been paid for 210 months, or to the 1st August 1828, as per register.

Examined, R. de Silva.

Certified, 20th January, 1829, F. F. Clementson,
Deputy Accountant General.

Madras, 2d October, 1829. Received in cash the 12 months' interest, due on the 1st August last, Rs. 39,236 6. 4. Vide letter from Government, dated 2d December 1829.

Binny & Co., Attorneys, and Agents of the Rajah of Coorg.

Madras, 20th August 1830. Received in cash the 12 months' interest, due on the 1st August, Madras Rs. 39,236 6. 4. Vide letter from Government, dated 25th August 1830.

Binny & Co., Attorneys.

Madras, 23d September 1831. Received in cash the 12 months' interest, due on the 1st ultimo, Madras Rs. 39,236 6. 4.

Binny & Co., Attorneys.

APPENDIX (B).

EXTRACT from the Last Will and Testament of *Veer Rajundur Wadeer*, Ex-Rajah of Coorg.

I HEREBY authorise and empower Sir John Login and Robert Montgomery Martin, my executors, or the survivor of them, or other the trustee or trustees of this my will, or the person or persons who for the time being shall be my personal representative or representatives, at their or his own absolute discretion, to carry on and prosecute, or to refer to arbitration, or compound or otherwise settle, or to discontinue the suit in the High Court of Chancery in England, which I have instituted against the late East India Company, and now in prosecution against the Secretary of State in Council of India;

and also to institute and prosecute any other proceeding in any court of judicature for recovering and enforcing payment of the moneys the subject-matter of the said suit. I earnestly request and implore the Government of India, administered in the name or on behalf of the Sovereign of England, to pay to or for the benefit of my said three wives and my said children, the pension which has been hitherto paid to me or for my use by the Government of India, or to make some other suitable provision for them.

London, 20 June 1859.

APPENDIX (C).

COPY of the Judgment and Decree of His Honour the Master of the Rolls, bearing date the 8th day of December 1860.

Rolls Court, Chancery Lane,
Saturday, 8 December 1860.

WADEER v. THE EAST INDIA COMPANY.

The Master of the Rolls.—This is a suit instituted by the ex-Rajah of Coorg, against the East India Company, to recover two Government promissory notes, together with the interest secured by them. One of them is a note to secure the sum of 653,940 Madras rupees, with interest at 6 per cent., and the other to secure 203,900 sicca rupees, with interest at 4 per cent.

The circumstances connected with the origin of these notes are not very material for the decision of the question in this cause. Rajah Veer, the Rajah of Coorg, had advanced money to the East India Company, in respect of which he was a creditor, holding notes of the Government, issued under the authority and by the sanction of the Government. One of these notes (namely, that for 653,940 Madras rupees) was made out in the name of his daughter, Dayoo Amahjy; the other note was made out in the name of the Rajah himself, and was originally for 278,800 sicca rupees. The former note still remains in the name of the Princess Dayoo Amahjy, for the amount I have mentioned, with interest at 6 per cent. The other note has been cancelled, partly paid off; and ultimately a new note for 203,900 sicca rupees, with interest at 4 per cent., was issued on the 1st of May 1832, and was made payable to the plaintiff, his executors and administrators. I call him the plaintiff, though he died pending the suit, and it has been revived by his legal personal representative, but nothing turns on this.

At the beginning of the year 1834 the plaintiff was Rajah of Coorg, and was a creditor of the East India Company for the amount secured by both these notes, both of which were then in his possession or power. Whether his possession of or title to them was attributable to his royal character as Rajah of Coorg, or to his private character, is a question of material importance in the determination of this question, to which I shall presently address myself. Early in 1834, differences arose between the East India Government and the plaintiff. The Government made war against the plaintiff, and in April 1834 Coorg was taken, his territories were annexed to the British territory in India, and the plaintiff himself was made a prisoner. His property was divided as booty of war. This, however, which was divided, did not, in fact, include either of the notes, as will appear from an inventory of such booty, which was made out and proved in the cause. The ex-Rajah practically remained a prisoner during the remainder of his life. He was permitted to visit this country in 1850, and in 1854 this Bill was filed.

The defence is, that this Court has no jurisdiction to entertain the question; that this is a case of the property of a captive prince taken by a hostile Power in war, and in the exercise of its political power, and in its character of a Sovereign Power. If this be a correct description of it, such a transaction, undoubtedly, is not cognisable by any court of justice. The East India Company obtained possession of the two notes in the following manner:—The note for 203,900 sicca rupees had been left by the plaintiff in the hands of Mr. Casamajor, the British Resident at Mysore, of which Coorg was a dependency; and in January 1835 Captain Chalmers, the Superintendent at Mysore, took possession of this note, giving a receipt for it to the Resident at Mysore. It was then sealed up in a cover, which was fastened with the official seal of the Commissioner of the Mysore Government. It was then placed in the Treasury, where it has since remained, and no interest has been paid upon it since 1834. The other note was, in 1834, in the hands of Messrs. Binny & Co., as the agents of the plaintiff; and after some correspondence and a considerable delay, it was, in 1840, delivered up to the defendants on giving an indemnity to Messrs. Binny & Co., and by the defendants it was deposited in the Government Treasury. No interest has been paid upon it since 1834.

I think that the acts proved establish that these notes were taken possession of by and on the part of the defendants. Much stress was laid in argument before me, on the endorsement on the original cover in which the note for 203,900 sicca rupees was placed and sealed up when delivered to the agent of the defendants, which endorsement is to this effect, namely (it is in both languages, both in Hindustani and in English): "A Bengal promissory note for 203,900 sicca rupees, belonging to the ex-Rajah of Coorg." But, after carefully considering this, I think that nothing turns on this endorsement. It was clearly not meant to be, and I think it cannot be, properly interpreted to constitute any waiver on the

part

part of the defendants to the property of the note, if, independently of any such endorsement, they were entitled to it. Neither can it be treated as a declaration of trust, or any disclaimer of ownership on their part. It seems to me to have been intended to be, and that it really is, only a mere description of the source from whence the property was derived, and that it does not amount to any admission that the defendants are trustees of it for the plaintiff.

The principal difficulty I have felt in this case has arisen from the double character filled by the defendants, the East India Company. They were both a Company of Merchants trading to the East Indies and a Sovereign Power; and, so far as the Rajah of Coorg was concerned, a Sovereign State wholly independent and at war with him. From hence follows, that the acts done by the defendants are frequently of an ambiguous character, and that it becomes extremely difficult to ascertain whether any particular act is to be attributed to the exercise of the political power of a Sovereign State, or to the act of a Company of Merchants trading to the East Indies. If this case can fairly be represented to be the instance of a foreign power taking prisoner an enemy, and by means thereof, and whilst so holding him, obtaining the possession of documents which established his right to recover a debt due from another to him in his private capacity, then I am clear that the plaintiff is entitled to relief; and the circumstance that the defendants constitute both the conquering power and the debtor, does not in any respect vary the question. But if the notes were the property of the plaintiff in his character of Rajah, and if they were taken possession of by the defendants in the exercise of their sovereign and political power, then I am equally clear that this Court cannot interfere. On the first point, the evidence satisfies me that these notes belonged to the plaintiff in his character of Rajah of Coorg, and not in any private character apart from such office. It is clear to me, that unless he had been Rajah of Coorg he could not have had any right to them, or any means of obtaining possession of them, nor could he have procured the payment of the interest or dividends due upon them. This is, I think, very important. The burthen lies on the plaintiff to establish that the notes were his property in his private right; and it would have been necessary for him, in order to establish this, to show that, according to the law regulating the inhabitants of Coorg, he would have been possessed of them if he had not been the Rajah. Not only has he not complied with these obligations, but the evidence, as far as it goes, shows that he would not have been so entitled but for his character of Rajah. If so, they were held by him as part of the *jura regalia*, and not as *jus privatus*. They were both taken possession of, one by the Superintendent Commissioner, the political officer of the Government, and the other under an indemnity given to the agent of the plaintiff in the manner to which I have already referred. These circumstances, in my opinion, amount to a taking possession of them by the defendants in the exercise of their sovereign and political power. It is clear that, in this act of taking possession of the notes, it was in no mercantile character that they could have taken or retained them. If this be so, as in my opinion it is, then the authorities to which I was referred, and which I have carefully examined from Vattel, and various other cases, particularly those in the Duke of Newcastle's Answer to the Prussian Government on the seizure of the Silesian debt due to British subjects, do not apply to this case; but the case falls within the rule laid down, and the cases cited in the case of *The East India Company v. The Rajah of Tanjore*; and I am of opinion that the taking possession of the notes by the East Indian Government were acts done in the exercise of their sovereign power, and that those acts are not subject to the control of this Court. I must, therefore, direct the Bill to be dismissed, but I must do so without costs.

APPENDIX (D.)

COPY of the Royal Warrant of his late Majesty King William IV., granting the Booty which had been taken at Coorg.

WILLIAM R.

WILLIAM the FOURTH, by the grace of God of the United Kingdom of Great Britain and Ireland King, Defender of the Faith, &c., To all to whom these presents shall come, greeting: Whereas the Commissioners of Our Treasury have represented unto Us, that as it had been made appear to them, by a report of Our Procurator General, that hostilities having been commenced against the Rajah of Coorg in the East Indies, the fortress of that Rajah was invested and taken possession of on or about the 6th day of April in the year 1834, by certain of Our troops and of the troops of the East India Company, and considerable booty taken therein, an account of which had been rendered to the same Company by the agents employed for that purpose, of which the following is a statement:—

	Rs.
From the fort and town of Maddakaree and its neighbourhood, and by the sale of various properties and effects taken therein - -	12,49,834
Amount of concealed treasure dug up at Ramasawuy Kenaway, estimated at - - - - -	2,19,402
Amount of two bags of gold coins dug up at the same place - -	17,984
Amount of two bags of gold coin given up by Chin Buswapah - -	9,515
Rs.	14,96,735

And whereas Our said Commissioners have further represented unto Us that the said booty does of right belong to Us in virtue of Our Royal Prerogative, and that the said booty should be given and granted in such manner as to Us should seem meet and just. And whereas, as a memorial has been addressed to Our said Commissioners on the part and behalf of the East India Company and of the captors, praying that we would be graciously pleased to grant to the said Company all such booty and plunder, stores, provisions, and things as are hereinbefore mentioned to have been taken during the said hostilities in Coorg territory, and also all such ordnance and military stores as were taken possession of in the said fort and territories of the said Rajah of Coorg, as to one-half part of the value thereof, for the proper use of the said Company, and as to the other half part thereof for the use of the commander, officers, and men belonging to the army employed in the hostilities before mentioned, and that We would give such directions as to the appropriation and distribution of the said plunder and booty amongst the said forces as to Us shall seem fit. And whereas Our said Commissioners have recommended unto Us to accede to the prayer of the said Memorial by granting the booty in question in manner hereinafter mentioned, to which We being graciously pleased to condescend, We do hereby give and grant to the East India Company all such booty and plunder, stores, provisions, and things as are hereinbefore mentioned to have been taken during the said hostilities in Coorg territory, and also all such ordnance and military stores as were taken possession of in the said fort and territories of the said Rajah of Coorg, in trust as to one-half part of the value thereof for the proper use of the said Company, and as to the other half part thereof in trust for the use of the commander, officers and men belonging to the army employed in the hostilities before-mentioned, to be distributed to and amongst them according to the usage of the army in India; and We are graciously pleased to order and direct, that in case any doubt shall arise respecting the claims to share in the distribution of the moiety hereby granted to the captors, or respecting any demand upon the said captured booty, the same shall be determined by the said East India Company, or by such person or persons to whom they shall refer the same, which determination thereupon made, shall with all convenient speed be notified in writing to the Commissioners of our Treasury, and the same shall be final and conclusive to all intents and purposes, unless within three months after the receipt thereof, at the office of the Commissioners of Our Treasury, We shall be pleased otherwise to order, hereby reserving to Ourselves to make such order therein as to us shall seem fit. Given at Our court at St. James's, the 6th day of June 1835, in the fifth year of our reign.

APPENDIX (E.)

EXTRACTS from the *Wellesley* and *Wellington* Despatches, &c., respecting the Coorg Family.

No. I.—DECLARATION made by Lieutenant General Sir *Robert Abercromby*, Commander in Chief of the Bombay Army in the War against *Tippoo Sultan*, dated Cannanore, 31 March 1793.

HALLAREE VEERA, Rajah of Coorg, “entered most heartily into the war (1791–92), and supplied the Bombay Army under my command with a quantity of grain and cattle, without which the troops would have been greatly distressed, and for which he has hitherto declined taking any pecuniary compensation. From the commencement of the war till its conclusion, the Rajah continued most firmly attached to the interests of the Company, notwithstanding the repeated attempts of Tippoo to seduce him.”

In a letter to the Rajah, dated Madras, 23d September 1793, Sir Robert Abercromby says “I shall always be extremely glad to hear from you, and to know from yourself that you and your people prosper and are happy, as the friendship which I entertain for you can only end with my life.”

No. II.—From DESPATCHES of the Marquis *Wellesley*, Governor General of India.

To the Commissioners of Malabar.

Fort St. George, 10 April 1799.

AFTER thanking the Commissioners for the establishment of large magazines of grain in Koorg, to provision the army besieging Seringapatam, his Lordship proceeds—“The Rajah of Koorg has seconded my views, and the exertions of the Company’s servants on this occasion, with a degree of spirit, energy, and fidelity which confirm the high character he had justly obtained in the late war (alluding to the great services rendered by the Rajah to the Marquis Cornwallis during the Mysore Campaigns in 1791–2). I have expressed my sense of his zealous attachment and honourable services in a letter which will be forwarded to you by the Persian translator, with a copy for your information. * * * I have no doubt that the exertions of the Rajah to collect grain for the use of the army will be continued as long as they shall be necessary, with the same spirit which has hitherto distinguished them.” (Vol. i. page 523.)

On the 23d May 1804, the Marquis Wellesley, in forwarding a sword to the Rajah (who fought at the head of his troops in defence of British supremacy), and granting an extension of territory to the Coorg dominion, said "I have had frequent occasion to express to you the sentiments of approbation with which I have contemplated the zeal and attachment which you have uniformly manifested during a long course of years towards the British Government."

EXTRACTS from the Supplementary Despatches of Field Marshal the Duke of Wellington.

No. III.—IN my journey through Koorg I saw the Rajah. He appeared to be much afraid that we, on the eastern side of the Peninsula, were not aware of the services which he had it in his power to render to the Company, and that we should listen to his enemies, who, he said, were very desirous of prejudicing us against him. After a long conversation he appeared better reconciled to us than he was at first. There is more simplicity in his manners and in what he says, and apparently more sincerity, than in any native that I have yet seen. He is much attached to the English, and it would certainly be a misfortune if he were to be estranged from us.—(Vol. i. page 507).

It may, therefore, be fairly concluded, that by the liberality of the Rajah of Koorg, the Company's treasury is richer at this moment no less than six lacs of rupees than it would have been if he had taken payment of the money expended, and for the supplies furnished by him. In this view of the question I do not take into consideration the nature of his services, or the time at which they were rendered; but I have stated particularly what the supplies furnished by him would have cost the Company if they had been furnished by any other person, as I formed thereon the amount of remuneration which I intend to recommend to your Lordship to grant to him.—(Vol. i. page 320).

I have seen the Rajah of Koorg three or four times on my journeys through this country; I have had constant intercourse with him, and I think him by far the best native that I have ever met. (Letter to the Honourable Henry Wellesley, Secretary to the Governor General, Vol. ii. page 410).

CIRCULAR to the Collectors in Malabar and Canara.

Sir,

Seringapatam, 19 October 1801.

I HAVE to inform you that, at the desire of the Governor General, the Governor of Goa has permitted the Rajah of Soonda to go from Goa into the Koorg country in order to marry the daughter of the Rajah of Koorg; and I have sent to the Rajah of Soonda a passport, and I have written to the officers commanding stations in Malabar and Canara, to request that they will give the Rajah of Soonda every assistance, and that they will show him every attention on his passage through the districts under their command. I am convinced that your knowledge of the *long and faithful services rendered to the Company by the Rajah of Koorg*, will induce you to give orders that every attention may be paid by the Company's servants under your authority, to a person about to be so nearly allied to him as the Rajah of Soonda, on his passage through your district. *The Rajah of Koorg has been in the habit of paying the greatest attention, not only to officers who may have had occasion to pass through his country, but even to private soldiers and Sepoys, and large detachments, and for some time even the whole Bombay army have been entertained by him;* for this reason, I should hope that, if it were possible, the Rajah of Soonda might pass through the Company's territories with his small train without expense to himself; and I am the more anxious upon this subject because I do not think it probable that this treatment of him can be drawn into a precedent on any future occasion. You, however, must be the best judge, and I only mention it for your consideration.

I have, &c.

(signed) Arthur Wellesley.

No. IV.—From Colonel Beatson's Official Account of Mysore War, p. lxxiv., Appendix.

"RICE and grain collected in the Coorg country for the use of the British army: rice 6,360,000 lbs., being, at 1 lb. per man, equal to the subsistence of 40,000 men for 159 days. Grain, 560,000 lbs., being t 10 lbs. per day per horse, grain for 2,800 horses for 20 days."

See also, from above-named work, letter from the Rajah of Coorg to the Governor General, received by his Lordship 14th April 1799, containing an account of the Battle of Sedaseer, and the means by which the position of the Mysore army was ascertained and its defeat secured, owing in a great measure to the conduct of the Rajah.

APPENDIX (F.)

No. I.—MINUTE recorded by Lieutenant Colonel *Carpenter*, Agent to the Governor General of India.

Benares, 1 January 1848.

THE period for my departure from Benares and return to Europe having arrived, I cannot part with his Highness the Rajah of Coorg, without giving him a testimonial of the sentiments with which he has inspired me.

Since the Rajah quitted his palace in Coorg, in April 1834, he has been under my charge, and I have infinite satisfaction in recording the quiet, peaceable, and exemplary behaviour of his Highness during the long period of nearly 14 years that I have been a constant observer of his conduct, and which has been several times favourably noticed in my various reports to the Supreme Government.

I am aware that, subsequent to the Rajah's deposal, numerous charges of cruelty and oppression, whilst he reigned in Coorg, have been brought against him; but I am bound in justice to declare, that during the whole time he has been under my care, no evidence of a cruel disposition has ever been exhibited; on the contrary, his manners and habits are mild and gentle in the extreme, and he has invariably won the regard and esteem of all parties with whom he came in contact since he quitted Coorg. Unfortunately, previous to that event, he had never seen more than half a dozen European officers in his life. The Rajah is a perfect specimen of an innate gentleman, though naturally reserved and shy, so that it becomes necessary to know him well to appreciate his many good and amiable qualities; he is particularly susceptible of attention and kindness.

In conclusion, I earnestly recommend him and his family to consideration, and heartily and sincerely bid him farewell, with my best and warmest wishes that comfort and happiness may attend them in every situation, and under all circumstances. The Rajah's numerous children are especial objects of care and anxiety to him, owing to the extreme difficulty of providing for their future welfare, more particularly the little girl he is in the habit of dressing in the European style. Any kindness to her is peculiarly gratifying to the Rajah, and he is very desirous that she shall be educated and brought up as if she were an European. Whatever arrangements he may wish to make for the future provision of the child will, I trust, receive the assistance and support of my successor, as far as it may be in his power to grant it.

(signed) *T. D. Carpenter*,
Lieutenant Colonel and Governor General's Agent.

No. II.—From Major *Macgregor*, who succeeded Lieutenant Colonel *Carpenter* in charge of the Rajah.

My Dear Rajah,

Cawnpore, 8 November 1849.

I WAS very sorry to find that I omitted, on the day of my departure from Benares, to bid you farewell. I can assure you that I separated from you with much regret; for during our intercourse, extending as it did over a period of upwards of 18 months, your *mild and gentlemanlike manners, and your very correct conduct on all occasions, completely won my good opinion and esteem. I shall ever feel a deep interest in the welfare of yourself and family.*

(signed) *G. H. Macgregor*.

No. III.—The Earl of *Ellenborough*, Governor General of India, to his Highness *Veer Rajundur Wadeer*, Benares.

Sir,

Allahabad, 20 May.

I CAN assure you that I sympathise very sincerely with your Highness in the position in which you and your young family are placed.

The concurrent testimony of all my countrymen who have had the good fortune to become personally acquainted with your Highness, in favour of your character and conduct during your residence at Benares, much strengthens my own feelings of sympathy, and will make me very desirous that it should be found practicable to make some arrangement satisfactory to your Highness and honourable to your exalted family.

I remain, &c.
(signed) *Ellenborough*.

*G. Arbuthnot, Esq., to H. Merivale, Esq. ; dated Treasury Chambers,
12 June 1861.*

I AM directed by the Lords Commissioners of Her Majesty's Treasury, to transmit the enclosed memorial from Sir John Spencer Login and Mr. Montgomery Martin, the executors of the late Rajah of Coorg, praying for the grant of certain property for the benefit of his heirs ; and their Lordships request that you will move the Secretary of State for India in Council, to favour them with an explanation regarding the disposition of the two promissory notes referred to, and also with any observations he may wish to offer regarding the claim advanced thereto by the executors of the late Rajah.

*T. G. Baring, Esq., to the Assistant Secretary to the Treasury ; dated India
Office, 3 August 1861.*

I AM directed by Sir Charles Wood to acknowledge the receipt of the duplicate of your letter of the 12th of June, the original of which does not appear to have been received in this office.

The enclosures, consisting of a letter and memorial, with appendix, from Sir John Login and Mr. Montgomery Martin, executors of the late ex-Rajah of Coorg, have been considered by the Secretary of State for India in Council, and I am instructed to communicate to you, for the information of the Lords Commissioners of the Treasury, with reference to the request of the petition that the Lords of the Treasury would appropriate the amount at their disposal to the benefit of the family, that Sir Charles Wood is not aware of any sum or sums of money being at the disposal of the Lords of the Treasury, which can be appropriated to the benefit of the family of the ex-Rajah.

*G. A. Hamilton, Esq., to Sir J. Login and R. M. Martin, Esq. ; dated
Treasury Chambers, 22 November 1861.*

THE Lords Commissioners of Her Majesty's Treasury have had before them the memorial which accompanied your letter of the 17th of May last, praying that Her Majesty may be advised to grant to you, as the executors of the late Rajah of Coorg, for the benefit of his family, certain securities, &c., which were formerly the property of the Rajah, but have now become vested in the Crown ; and I am directed to acquaint you that the result of the judgment of the Master of the Rolls, referred to in your memorial, was to leave the promissory notes in question at the disposal of the Crown as part of the revenues of India. They are accordingly in the possession of the proper authorities in India on behalf of the Indian Government, and there are no grounds on which my Lords can claim the same or interfere in your case.

*Sir J. S. Login and R. M. Martin, Esq., to the Lords Commissioners of
Her Majesty's Treasury, 31 January 1862.*

WE have the honour to acknowledge the letter of G. A. Hamilton, Esq., dated the 22d November 1861, containing a reply to the memorial presented by us to your Lordships on the 17th day of May 1861.

That letter states that the result of the judgment of the Master of the Rolls was to leave the two promissory notes in question at the disposal of the Crown "*as part of the revenues of India,*" and that "there are no grounds on which my Lords can claim the same or interfere in your case."

The latter clause seems to be a conclusion arrived at from the view previously expressed as to the effect of the Master of the Rolls' judgment. We, therefore, deem it our duty to call your Lordships' consideration to the terms of the judgment,

ment, as we are advised there is nothing in it which supports the view that the promissory notes in question, or the principal and interest secured thereby should be, or could be treated or dealt with as part of the revenues of India.

Those revenues are governed by laws subjected to charges and administered by a political machinery altogether distinct and different from those affecting the monies which are already in, or ought rightly to be brought into the Imperial Treasury or otherwise dealt with as vested in the Crown, under the general law or constitution of England. We submitted in our memorial, and again respectfully submit to your Lordships, that the monies secured by the above promissory notes came within the latter description.

There is nothing in the judgment referred to in any way calculated to support an opposite view. The result of it was simply to declare that a municipal court had no jurisdiction to entertain the suit. The suit of the late Rajah was founded chiefly on the following statements: first, that there had not been, under the circumstances detailed, any actual seizure of the promissory notes during war; that is, as booty of war or by right of conquest; and secondly, that, even if the act of seizure could be made out, it ought not to be given effect to, the nature of the thing seized being considered: viz., that it was a debt due from the British Government in India to the Rajah, arising out of loans of money made in absolute confidence and trust in the public faith; and which the public law of Europe declares to be exempt from confiscation and seizure in case of war. The effect of the allegations by way of defence set up in the answer of the defendants, the East India Company then representing the British Government in India, is clearly stated in the 4th paragraph of the judgment above mentioned, which, after declaring that the notes in question were to be considered *jura regalia*, belonging to the State of Coorg, proceeds as follows: "The defence is that this Court has no jurisdiction to entertain the question, that this is a case of the property of a captive prince *taken* by a hostile power *in war*, and in the exercise of its political power, and in its character of a sovereign power; if this be a correct description of it, such a transaction undoubtedly is not recognisable in any court of justice."

The judgment, after stating the particular facts of the case, concludes as follows: "and I am of opinion that the taking possession of the notes by the East India Government were acts done in the exercise of their sovereign power and that those acts are not subject to the control of this Court; I must, therefore, direct the Bill to be dismissed, but I must do so without costs."

Two conclusions directly arise from the above judgment, viz., the first, that the above-mentioned defence and the judgment of the Master of the Rolls treat the subject of the seizure as booty of war; and the second, that the Master of the Rolls held and declared that a municipal court had no jurisdiction to entertain a suit respecting it. Therefore, we considered it our duty to present our memorial to your Lordships. It is now respectfully submitted that it cannot be fairly contended that the result of the judgment of the Master of the Rolls was, "to leave the two promissory notes in question at the disposal of the Crown as part of the revenues of India," when the terms of that judgment are attentively considered with reference to the admitted principle that all property seized during war does of right belong to the Crown in virtue of the Royal prerogative, with full and absolute power to give or grant the same as to Her Majesty may seem meet and just. Your Lordships will remember that so the Lords' Commissioners of Her Majesty's Treasury for the time being advised his late Majesty, as is recited in the Warrant relating to the other portion of the State property of Coorg seized in the same war, forming Appendix (D.) of our memorial. We trust we have said enough to convince your Lordships that the monies in question do not form "a part of the revenues of India," but on the contrary, have been treated in the above-mentioned suit as the subject of hostile seizure during war, in fact, as booty of war, and therefore *ipso facto* vested in the Crown by Royal prerogative, so that your Lordships are clearly entitled to claim and hold the same for and on behalf of the Crown as we respectfully submit.

We therefore humbly and respectfully request your Lordships' attention to the prayer of our memorial and again solicit your Lordships to advise Her Majesty accordingly for the benefit of the family of the late Rajah.

Should your Lordships, however, entertain any special view of this matter differing from that expressed above, and should it be intended to abandon any claim which Her Majesty may have under Her Majesty's prerogative aforesaid

to

to the said property, we humbly request your Lordships to do us the favour to make such a communication to us on the subject as may enable us safely to act upon it. We, as the executors of the late Rajah of Coorg, would in that case be enabled to seek properly in another department of the State that justice and commiseration on behalf of the family of the deceased prince which they have deemed it their duty to seek in the first instance (for the reasons above stated) from your Lordships, according to the prayer of their memorial.

F. Peel, Esq. to Sir J. Login and R. M. Martin, Esq. ; dated Treasury Chambers, 7 March 1862.

THE Lords Commissioners of Her Majesty's Treasury have had before them your memorial of the 31st January, further relative to the promissory notes which belonged to the late Rajah of Coorg, and their Lordships have directed me to inform you that they adhere to the view stated in the letter of this Board, of the 22d November 1861, and decline to prefer any claim on the part of the Crown, against the Government of India, in respect of the promissory notes.

Sir J. S. Login and Montgomery Martin, Esq., to the Under Secretary of State for India ; dated 28 July 1862.

WE have the honour now to renew our application, on behalf of the family of the late Rajah of Coorg, made in our former correspondence with the late secretary to the East India Company, and the Right Honourable Her Majesty's Secretary of State for India.

In doing so we have to call to remembrance that the particular difficulty which then presented itself to the authorities at the India House, was to ascertain the nature of the property, or the rights which the late Rajah had in the promissory notes of the East India Company, retained (as complained of) by their officers on the dethronement of the Rajah, and the consequent seizure and annexation of his Principality of Coorg ; as it was considered that the right of these authorities to deal with the fund represented by these Government notes, in the way requested by us for the benefit of the family, depended upon the decision of that question.

It will also be remembered that it was suggested to us by these authorities that we should continue the equity suit then pending, and which was brought by the late Rajah in his lifetime against the East India Company, in order, if possible, that the legal or equitable rights of the Rajah, and those claiming through him, might be judicially decided in the suit. In consequence, we as the executors of the late Rajah took the necessary steps for carrying on that suit which had become abated by his death.

On the 8th December 1860, his Honor, the Master of the Rolls, pronounced his decree in that suit, by which it was declared and decreed that the several acts of taking possession of the above Government notes by the East India Company, through their officers, were acts done in the exercise of their sovereign power, and that, therefore, these acts were not subject to the control of that or any other municipal court, and the suit was accordingly dismissed, but without costs.

The suit of the late Rajah was founded on the following statements : first, that there was not any actual seizure of the Government notes, during war, or by right of conquest, so as to constitute them booty of war ; secondly, that if otherwise, such seizure ought not to be given effect to with reference to the nature of the property seized, being, in fact, a debt due from the British Government in India to the Rajah arising out of loans made in absolute confidence and trust in the public faith, and which the public law of Europe declares to be exempt from confiscation and seizure in case of war. The counter-statements which the East India Company, the defendants, pleaded by way of defence were that the Government notes should be considered *jura regalia* belonging to the State of Coorg, and were taken by a hostile power in war, in the exercise of political

and sovereign power, and that, therefore, the Court had no jurisdiction to entertain the question. The decree of the Master of the Rolls, in effect, determined that neither that court, nor any other court of law or equity could entertain the important question secondly raised by the late Rajah in the suit as above-mentioned, viz., that the seizure ought not to be given effect to by reason of the subject-matter of the seizure being a part of the funded debt of the country; we, therefore, considered it our duty to apply to the Lords Commissioners of Her Majesty's Treasury on behalf of the family of the late Rajah.

The impression on our minds which induced this step was, that the Master of the Rolls having decided the first point, or question raised, viz., that there had been an actual seizure, by an exercise of political and sovereign power, it was necessarily to be inferred that the subject of the seizure would then be treated by Her Majesty's advisers as booty of war, vesting under the Royal prerogative in Her Majesty, with full power to give or grant the same as to Her Majesty might seem meet and just, in accordance with the terms of the Warrant of his late Majesty William IV., under which the other property of the late Rajah seized at Coorg was dealt with, granted, and apportioned to the East India Company, and others.

It, however, appears by the letter of G. A. Hamilton, Esq., dated 22d November 1861, in reply to our memorial presented to the Lords Commissioners, and it was their Lordships' opinion that the result of the judgment of the Master of the Rolls was to leave the above Government notes at the disposal of the Crown "as part of the revenues of India," and that, therefore, there were no grounds on which their Lordships could claim the same or interfere in the case.

In a subsequent letter, dated the 7th March 1862, received by us in reply to our further communication in explanation, the Lords Commissioners, through Frederick Peel, Esq., intimated that they adhered to the view stated in the former letter of the 22d November 1861.

The abandonment of all claim on the fund by the Lords Commissioners representing the rights of the Imperial Treasury, leaves the same to be dealt with by the Right Honourable the Secretary of State for India. We, therefore, now respectfully renew our former application to the Government of India, and do most earnestly and anxiously submit to the consideration of the Secretary of State the important point *secondly* raised in the suit, but not adjudicated on by reason of the want of jurisdiction in the municipal tribunals, as above shown, to entertain it.

That point involves the question arising out of the principles of public law, as recognised and acted on by the civilised world, and which declare it to be a violation of the public faith to confiscate the monies or debts which it owes to the enemy.

The following extracts from Vattel support this view: "Everything that belongs to the nation is subject to reprisals whenever it can be seized, *provided it be not a deposit entrusted to the public faith*. As it is only in consequence of that confidence which the proprietor has placed in our good faith that we happen to have such deposits in our hands, it ought to be respected, even in case of open war. Such is the conduct observed in France, England, and elsewhere, with respect to money which foreigners have placed in the public faith."—"Vattel's Law of Nations," Book II., ch. 18, sec. 344. "The State does not so much as touch *the sums which* it owes the enemy. Money lent to the public is everywhere exempt from confiscation and seizure in case of war."—*Ibid*, Book III., ch. 5, sec. 77, page 323.

We would, however, rather address ourselves to the liberal and generous sentiments of the Minister for India representing Her Gracious Majesty, than rely solely on any point of public law, however much in favour of the claim of those for whom we are interested.

In that view we respectfully request the consideration of the Minister to the hardships endured by the late Rajah, from the time of his dethronement to his death and exile from his country, during all which time he exhibited patience and submission under his misfortunes, and hearty and zealous attachment to the power of Her Majesty and to the British Crown; to the eminent services, during a long period, and friendly alliance of the Rajahs of Coorg, acknowledged both by the late Duke of Wellington and the late Marquis of Wellesley; and to the now restricted means of his innocent children and widows, being all who remain of the late Royal Family of the Principality of Coorg, now forming an integral portion

portion of the territories of British India. It must be well known to the Minister, however, that the Indian Government have derived great pecuniary gain, as well as political advantages, by the annexation of that country. In addition to booty taken, the British Government have benefited largely by the surplus revenue of Coorg, which is estimated at 20,000 *l.* per annum, while the geographical position of the country gives it a strategical and military importance, as well as rendering it valuable for the settlement of Europeans.

In conclusion, permit us to draw the special attention of the Minister to the very small allowances which the late Rajah received from the Indian Government, compared with what other dethroned Princes, and even their subordinate relatives and officers, have received from the same Government.

Under these circumstances, we entertain the hope that the Right Honourable the Secretary of State for India will appropriate the amount of the funds in question, amounting in all to about 200,000 *l.*, including both principal and interest, and now at his disposal, as above shown, to the benefit of the immediate members of the late Rajah's family, in such manner as may be deemed most advisable.

We consider it proper to transmit, and to respectfully submit to the Secretary of State, copies of the whole of the correspondence with the Lords Commissioners of Her Majesty's Treasury.

Herman Merivale, Esq., to Sir J. S. Login and Montgomery Martin, Esq.;
dated India Office, 5 January 1863.

IN reply to your letter of the 28th July last, submitting a renewed application on behalf of the family of the late ex-Rajah of Coorg to the benefit of the Government promissory note, so long the subject of litigation in this country, I am directed by Sir Charles Wood to acquaint you that Her Majesty's Government, being of opinion, after full consideration, that the arrangements made in India and in England for the maintenance of the family of the late ex-Rajah are liberal and sufficient, he cannot see any reason for disturbing them, nor for making any appropriation of the Government promissory notes, to which you alluded, in favour of the members of the Coorg family.

RAJAH OF COORG.

COPY of CORRESPONDENCE between Sir J. S. Logan and Robert Montgomery Martin, Esq., as Executors of the Will of the late Ex-Rajah of Coorg, and the Lords Commissioners of Her Majesty's Treasury, the Secretary of State for India, and the Court of Directors of the East India Company; and all DOCUMENTS connected with the Subject to which the above Correspondence refers.

(Mr. Henry Baillie.)

*Ordered, by The House of Commons, to be Printed,
22 July 1863.*

578

EAST INDIA (ELECTRIC TELEGRAPHS).

RETURN to an Address of the Honourable The House of Commons,
dated 20 February 1862 ;—for,

A “RETURN of the entire EXPENDITURE, in *England* and in *India*,
on account of ELECTRIC TELEGRAPHS in *India*, showing the Amount
expended yearly on account of Permanent Works, and on Annual
Maintenance and Expenses :”

“And, ACCOUNT of the ANNUAL RECEIPTS from the TELEGRAPHS, and
of the Number of MILES and of TELEGRAPH STATIONS open, in each
Year.”

India Office, }
19 May 1863. }

W. T. THORNTON,
Secretary, Public Works Department.

(Mr. Ayrton.)

Ordered, by The House of Commons, to be Printed,
19 May 1863.

(B.)—STATEMENT of RECEIPTS by Sale of Unserviceable Stores and Fines on account Construction of the GOVERNMENT TELEGRAPH LINES in India, from 1850-51 to 1861-62.

	Bengal.	North Western Provinces.	Bombay and Guzerat.	Madras.	East Coast.	Central India.	Dacca.	Scinde.	Pegu.	South-East Coast.	Indore.	TOTAL.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1850-51 -	-	-	-	-	-	-	-	-	-	-	-	-
1851-52 -	-	-	-	-	-	-	-	-	-	-	-	-
1852-53 -	-	-	-	-	-	-	-	-	-	-	-	-
1853-54 -	173 4 7	-	-	-	-	-	-	-	-	-	-	173 4 7
1854-55 -	693 9 10	-	-	-	-	-	-	-	-	-	-	693 9 10
1855-56 -	1,688 6 4½	-	1,746 10 -	990 2 4	-	-	-	-	-	-	-	4,425 2 8½
1856-57 -	2,319 2 9	-	1,754 3 6	209 9 6	-	25 -	-	-	21 8 7¾	-	-	4,329 8 4¾
1857-58 -	1,828 9 2½	-	412 9 5	15 2 6	50 9 3	25 -	-	-	-	-	-	2,331 14 11½
1858-59 -	366 5 2	-	987 11 1	1,265 14 5	432 7 11	65 12 -	88 13 11	-	579 14 5½	-	-	3,786 14 11½
1858-60 -	697 - -	-	130 - -	-	1,065 9 -	355 10 -	93 8 -	-	1,447 1 11	-	-	3,788 12 11
1860-61 -	-	-	-	-	-	285 4 9	114 7 -	354 13 8	-	-	-	754 9 5
1861-62 -	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL - -	7,765 5 11	- -	5,031 2 -	2,775 - 9	1,548 10 2	756 10 9	296 12 11	354 13 8	2,048 9 -¼	- -	- -	20,578 1 2¼

Calcutta, 20 March 1863.

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.

SUPPLEMENTARY STATEMENT of RECEIPTS by Recoveries on account Short Delivery and Sale of Stores on account Construction of the GOVERNMENT TELEGRAPH LINES in India, during the Years 1860-61 and 1861-62.

C I R C L E S.	1860-61.			1861-62.			T O T A L.		
	Recoveries on Account Short Delivery of Stores.	Amount Realized by Sale of Stores.	TOTAL.	Recoveries on Account Short Delivery of Stores.	Amount Realized by Sale of Stores.	TOTAL.	Recoveries on Account Short Delivery of Stores.	Amount Realized by Sale of Stores.	TOTAL.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Store Department - - - - -	8,096 2 -	- - -	8,096 2 -	387 - -	44 9 5	431 9 5	8,483 2 -	44 9 5	8,527 11 5
	TOTAL Rs.								

Calcutta, 7 April 1863.

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.

(C.)—STATEMENT showing the CASH RECEIPTS on account of Private Messages, Fines, and Sale of Unserviceable Stores and

Official Year.	B E N G A L.					NORTH WESTERN PROVINCES AND PUNJAB.					BOMBAY AND GUZERAT.				
	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1850-51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1851-52	2,564 14 9	3,432 6 4	- -	- -	5,997 5 1	—	—	—	—	—	—	—	—	—	—
1852-53	8,139 - -	10,359 7 -	- -	- -	18,498 7 -	—	—	—	—	—	—	—	—	—	—
1853-54	11,219 1 6	12,209 9 3	104 2 2	- 3 -	23,532 15 11	—	—	—	—	—	—	—	—	—	—
1854-55	30,714 1 3	20,030 7 6	237 11 -	1 2 -	50,983 5 9	- -	- -	- -	- -	- -	7,831 15 -	2,467 3 -	47 - -	- -	10,346 2 -
1855-56	1,11,604 12 7	33,981 10 -	1,188 3 5	831 - 2	1,47,605 10 2	8,592 13 -	*18 - -	- -	68 12 -	8,679 9 -	39,171 1 -	8,433 8 -	493 - 8	- -	48,097 9 8
1856-57	93,479 2 3	33,295 3 -	426 9 4	215 2 -	1,27,416 - 7	29,506 14 -	12,618 10 -	299 2 8	614 6 2	43,039 - 10	55,473 14 5	12,062 12 -	134 2 9	- -	67,670 13 2
1857-58	42,794 13 3	66,128 1 -	774 3 -	223 10 -	1,09,920 11 3	12,319 14 -	- * -	5 - -	- -	12,324 14 -	57,613 3 -	59,072 - -	591 10 1	- -	1,17,276 13 1
1858-59	74,237 9 6	1,06,540 2 6	1,206 10 10	53 - -	1,82,037 6 10	30,404 4 9	- * -	210 10 -	- -	30,614 14 9	87,177 2 8	65,674 13 6	737 6 9	- -	1,53,589 6 11
1859-60	1,11,272 3 6	41,156 15 8	2,186 9 11	240 3 9	1,54,856 - 10	27,294 12 6	26,086 15 -	435 14 4	32 - -	53,849 9 10	1,19,047 3 -	15,867 9 -	1,232 2 3	183 4 3	1,36,330 2 6
1860-61	1,46,032 8 3	40,486 4 2	4,781 10 4	1,039 12 6	1,92,340 3 3	31,637 15 11	23,955 1 4	656 13 3	251 9 6	56,501 8 -	1,48,838 4 4	16,720 12 9	472 12 3	642 4 -	1,66,674 1 4
1861-62	1,61,955 14 -	40,692 11 6	3,767 1 2	593 5 -	2,07,008 15 8	30,993 9 6	28,501 11 -	503 2 8	267 14 9	60,266 5 11	1,50,071 3 6	19,649 9 3	840 2 3	1,233 8 7	1,71,794 7 7
TOTAL Rs.	7,94,014 - 10	4,08,312 13 11	14,672 13 2	3,197 6 5	12,20,197 2 4	1,70,730 3 8	91,180 5 4	2,110 10 11	1,234 10 5	2,65,275 14 4	6,65,223 14 11	1,99,948 3 6	4,548 5 -	2,059 - 10	8,71,779 8 3

Official Year.	I N D O R E.					S C I N D E.					D A C C A.				
	Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1850-51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1851-52	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1852-53	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1853-54	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1854-55	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1855-56	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1856-57	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1857-58	5,694 - -	7,954 12 -	34 - -	- -	13,682 12 -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1858-59	8,138 15 -	31,409 13 -	254 13 6	- -	39,803 9 6	4,513 11 -	- -	68 4 -	- -	4,581 15 -	212 12 -	569 13 -	5 13 3	- -	788 6 3
1859-60	12,071 12 10½	2,920 3 -	192 14 10	10 - -	15,194 14 8½	18,198 8 6	- -	409 11 8	- -	18,608 4 2	1,405 15 -	1,312 - -	49 4 9	- 10 -	2,767 13 -
1860-61	24,204 9 -	3,807 12 -	337 15 11	297 5 6	28,647 10 5	12,861 9 -	5,869 11 -	655 6 10	215 12 -	19,602 10 10	3,972 2 9	2,113 13 -	- -	- -	6,085 15 9
1861-62	18,239 - -	3,170 3 -	415 3 1	823 9 3	22,647 15 4	12,941 6 6	5,488 15 -	227 1 1	- -	18,657 6 7	7,777 11 -	808 1 6	317 8 10	75 13 -	8,979 2 4
TOTAL Rs.	68,348 4 10½	49,262 11 -	1,234 15 4	1,130 14 9	1,19,976 13 11½	48,515 3 -	11,358 14 -	1,360 7 7	215 12 -	61,450 4 7	13,368 8 9	4,803 11 6	372 10 1	76 7 -	18,621 5 4

* No account was rendered of the service messages sent during these years from offices of the North Western Provinces and Punjab.

Amount of Pro formâ Credits, on account of Service Messages, from the Year 1850-51 to 1861-62, both inclusive.

MADRAS.					EAST COAST.					CENTRAL INDIA.				
Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on account Private Messages.	Pro formâ Charges on account Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2,209 9 -	1,557 13 -	-	-	3,767 6 -	—	—	—	—	—	—	—	—	—	—
16,306 2 -	12,000 6 -	-	-	28,306 8 -	—	—	—	—	—	—	—	—	—	—
29,777 10 -	15,686 1 -	81 10 -	-	45,545 5 -	-	-	-	-	-	1,860 6 -	746 4 -	-	-	2,606 10 -
39,200 11 -	48,546 15 -	119 4 8	-	87,866 14 8	-	-	-	-	-	7,323 2 3	10,608 - -	-	-	17,931 2 3
46,327 13 3	39,066 5 -	255 13 -	-	85,649 15 3	8,173 3 -	-	62 8 -	-	8,235 11 -	4,430 - 6	6,590 1 6	-	-	11,020 2 -
65,451 13 10½	17,410 2 1	656 6 4	-	83,518 6 3½	18,944 7 4	2,305 7 9	140 1 10	-	21,390 - 11	13,665 2 -	3,450 9 4	219 4 7	-	17,334 15 11
69,673 12 3	15,430 15 2	793 2 1	-	85,897 13 6	27,827 4 8	2,725 2 8	233 4 1	513 5 -	31,299 - 5	15,141 12 6	3,848 12 -	167 11 1	-	19,158 3 7
72,228 8 6	14,498 10 2	308 2 5	125 - -	87,160 5 1	29,716 5 6	4,765 3 -	385 6 8	1,135 3 1	36,002 2 3	20,035 10 -	4,033 13 -	134 5 -	180 - -	24,403 12 -
3,41,175 15 10½	1,64,197 3 5	2,214 6 6	125 - -	5,07,712 9 9½	84,661 4 6	9,795 13 5	821 4 7	1,648 8 1	96,926 14 7	62,476 1 3	29,277 7 10	521 4 8	180 - -	92,454 13 9
PEGU.					SOUTH-EAST COAST.					TOTAL.				
Cash Receipts from Private Messages.	Pro formâ Charges on Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on Private Messages.	Pro formâ Charges on Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.	Cash Receipts on Private Messages.	Pro formâ Charges on Service Messages.	Receipts by Fines.	Receipts by Sale of Unserviceable Stores.	TOTAL.
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-	-	-	-	-	-	-	-	-	-	2,564 14 9	3,432 6 4	-	-	5,997 5 1
-	-	-	-	-	-	-	-	-	-	8,139 - -	10,359 7 -	-	-	18,498 7 -
-	-	-	-	-	-	-	-	-	-	11,219 1 6	12,209 9 3	104 2 2	- 3 -	23,532 15 11
-	-	-	-	-	-	-	-	-	-	40,755 9 3	24,055 7 6	284 11 -	1 2 -	65,096 13 9
187 8 -	1,081 8 -	-	-	1,269 - -	-	-	-	-	-	1,75,862 4 7	55,515 - -	1,681 4 1	899 12 2	2,33,958 4 10
6,157 10 -	6,932 10 -	-	-	13,090 4 -	-	-	-	-	-	2,16,255 8 8	81,341 8 -	941 8 9	829 8 2	2,99,368 1 7
9,782 2 -	10,051 - -	27 - -	-	19,860 2 -	104 4 -	-	-	-	104 4 -	1,74,832 1 6	2,02,360 12 -	1,551 1 9	223 10 -	3,78,967 9 3
11,544 13 -	14,928 14 -	145 2 3	916 6 3	27,535 3 6	137 - 4	-	-	-	137 - 4	2,75,297 5 -	2,64,779 14 6	2,947 1 7	969 6 3	5,43,993 11 4
11,799 7 7	5,293 14 -	55 4 -	66 - -	17,214 9 7	11,062 - 6	175 - 6	148 2 3	746 11 4	12,131 14 7	4,10,213 6 8	1,15,978 12 4	5,725 12 -	1,278 13 4	5,33,196 12 4
10,643 10 4	4,724 - 3	27 5 -	10 - -	15,404 15 7	13,444 7 10	561 3 8	29 - 9	170 8 -	14,205 4 3	5,04,278 - 10	1,20,243 12 -	8,155 1 7	3,140 8 6	6,35,817 6 11
20,577 11 6	3,830 3 6	121 10 -	83 12 -	24,643 5 -	24,025 12 1	402 6 6	47 4 -	35 - -	24,510 6 7	5,48,582 12 1	1,25,841 7 5	7,066 15 2	4,553 1 8	6,86,044 4 4
79,692 14 5	46,812 1 9	376 5 3	1,076 2 3	1,18,987 7 8	18,773 8 9	1,138 10 8	224 7 -	952 3 4	51,088 13 9	23,68,000 - 10	10,16,118 - 4	28,157 10 1	11,896 1 1	31,24,471 12 1
Add, Amount received by Sale of Unserviceable Stores, by the Store Branch of the Director General's Office, in 1861-62														507 10 -
GRAND TOTAL														34,24,979 6 4

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.

(D.)—STATEMENT showing the EXPENDITURE of the GOVERNMENT TELEGRAPH DEPARTMENT in India,

Official Year.	GENERAL.				B E N G A L.			NORTH WEST PROVINCES AND PUNJAB.		
	Salary of Head of Department.	SUPERINTENDENCE.			Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.
		Office Establishment.	Contingencies.	TOTAL.						
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
1850-51 - -	—	—	—	—	4,457 10 3	926 7 3	5,384 1 6	—	—	—
1851-52 - -	—	—	—	—	11,074 13 5	4,142 12 10	15,217 10 3	—	—	—
1852-53 - -	—	—	—	—	22,578 8 5	10,050 7 7	32,629 — —	—	—	—
1853-54 - -	19,966 2 4	—	(a) 2,230 — —	22,196 2 4	34,478 6 7	12,034 4 2½	46,512 10 9½	—	—	—
1854-55 - -	27,000 — —	(b) — —	—	27,000 — —	(c) 1,14,192 7 11	(c) 58,826 — 7½	1,73,018 8 6	7,052 12 4	4,259 7 5	11,312 3 9
1855-56 - -	36,183 2 1	1,806 4 2	613 14 9	38,603 5 —	54,012 4 2½	32,288 — 1	86,300 4 3½	99,686 2 5	55,832 8 3½	1,55,518 10 8½
1856-57 - -	35,322 9 3	4,291 4 7	5,276 11 9	44,890 9 7	90,478 11 1	43,222 — 9	1,33,700 11 10	52,834 13 3	18,328 11 2	71,163 8 5
1857-58 - -	39,486 1 8	8,707 — —	2,771 14 10	50,965 — 6	1,21,945 1 11	(c) 81,402 3 2	2,03,347 5 1	1,17,467 3 7	59,239 5 3	1,76,706 8 10
1858-59 - -	36,000 — —	2,760 5 8	712 13 —	39,473 2 8	1,60,304 — 11½	79,243 14 2	2,39,547 15 1½	77,534 3 8	52,138 — 8	1,29,672 4 4
1859-60 - -	36,672 6 8	5,350 12 4	245 5 6	42,268 8 6	1,82,817 9 3	79,087 14 9	(c) 2,61,905 8 —	90,213 11 1	32,354 10 6	1,42,568 5 7
1860-61 - -	36,000 — —	10,061 8 1	1,860 14 7	47,922 6 8	1,59,133 — —	52,499 — —	2,11,632 — —	92,731 12 9	19,202 10 11	1,11,934 7 8
1861-62 - -	36,000 — —	15,282 4 —	1,816 15 —	53,099 3 —	—	—	—	—	—	—
	3,02,630 6 —	48,259 6 10	15,528 9 5	3,66,418 6 3	9,55,472 10 —	4,53,723 1 5	14,09,195 11 5	5,37,520 11 1	2,61,355 6 2½	7,98,876 1 3½
Add, Amount of inefficient Balance remaining unadjusted on the 30th April 1861 - - -				—	—	—	25,930 1 9	—	—	43,920 13 9
TOTAL - - - <i>Rs.</i>				3,66,418 6 3	—	—	14,35,125 13 2	—	—	8,42,796 15 —½

Official Year.	I N D O R E.			S C I N D E.			D A C C A.		
	Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.
	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
1850-51 - -	—	—	—	—	—	—	—	—	—
1851-52 - -	—	—	—	—	—	—	—	—	—
1852-53 - -	—	—	—	—	—	—	—	—	—
1853-54 - -	—	—	—	—	—	—	—	—	—
1854-55 - -	—	—	—	—	—	—	—	—	—
1855-56 - -	—	—	—	—	—	—	—	—	—
1856-57 - -	—	—	—	—	—	—	—	—	—
1857-58 - -	11,541 6 10	7,051 15 3	18,593 6 1	—	—	—	—	—	—
1858-59 - -	35,682 12 11	13,046 10 10	48,729 7 9	(d) 45,194 15 1	—	45,194 15 1	1,796 — —	2,598 4 9	4,394 4 9
1859-60 - -	30,673 15 6	14,166 12 3½	44,840 11 9½	47,974 7 5	25,402 5 7	73,376 13 —	11,319 5 1	4,567 15 8	15,887 4 9
1860-61 - -	52,390 15 6	29,566 5 11	81,957 5 5	65,815 — —	10,100 — —	75,915 — —	31,002 4 10	7,972 12 1	38,975 — 11
1861-62 - -	55,268 6 4	20,222 9 10	75,491 — 2	45,032 3 7	27,136 11 5	72,168 15 —	54,427 15 4	27,041 — 3	81,468 15 7
	1,85,557 9 1	84,054 6 1½	2,69,611 15 2½	2,04,016 10 1	62,639 1 —	2,66,655 11 1	98,545 9 3	42,180 — 9	1,40,725 10 —
Add, Amount of inefficient Balance remaining unadjusted on the 30th April 1861 - - -			15,412 15 11	—	—	17,490 — 7	—	—	28,325 15 1
TOTAL - - - <i>Rs.</i>			2,85,024 15 1½	—	—	2,84,145 11 8	—	—	1,69,051 9 1

NOTE (a). Travelling and contingent charges of Dr. O'Shaughnessy's returning to India from England.

(b). The charges of Superintendent's Office Establishment and Contingencies for this year are included in the Contingent Account.

(c). The actual expenses of each year are not shown in this statement, but the amount of bills actually adjusted in each year are entered here.

(d). The Contingent charges of the Scinde Circle of this year are included in this amount.

(e). Includes charges of the Office of Director, Eastern Division.

(f). Ditto - - - ditto - - - Western Division.

(g). Ditto - - - ditto - - - Southern Division.

on account of Working and Maintenance of the Lines from the Year 1850-51 to 1861-62, both inclusive.

BOMBAY AND GUZERAT.			MADRAS.			EAST COAST.			CENTRAL INDIA.		
Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.
<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
8,576 4 4	2,904 9 3	11,480 13 7	5,193 9 2	3,553 4 10	8,746 14 —	—	—	—	—	—	—
42,868 14 9	22,286 3 3	65,155 2 —	30,597 12 4	15,554 7 10	46,152 4 2	—	—	—	—	—	—
66,770 — 10	28,494 10 —	95,264 10 10	48,253 7 10	9,240 2 —	57,493 9 10	—	—	—	260 — —	221 15 4	481 15 4
93,591 12 9	58,198 6 5	1,51,790 3 2	74,419 1 8	19,277 14 10	93,697 — 6	2,476 4 9	432 10 2	2,908 14 11	5,155 8 11	4,139 2 5	9,294 11 4
89,297 1 1	90,184 8 2	1,79,481 9 3	1,01,319 2 6	45,783 2 10	1,47,102 5 4	37,892 3 3	10,240 5 5	48,132 8 8	7,270 11 7	6,221 2 7	13,491 14 2
94,941 4 11	55,427 14 7	1,50,369 3 6	1,26,541 4 3	70,764 12 7	1,97,306 — 10	47,150 13 10	5,361 8 7	52,512 6 5	35,094 13 5½	6,184 11 10	41,279 9 3½
(f) 1,12,809 2 6	63,380 14 10	1,76,190 1 4	(g) 1,06,669 — —	1,60,879 — —	2,67,548 — —	76,240 — —	31,811 15 11	1,08,051 15 11	68,141 10 11	30,677 3 5	98,818 14 4
1,07,535 — 6	45,006 4 3	1,52,541 4 9	1,28,136 10 2	67,825 10 1	1,95,962 4 3	92,527 3 5	25,047 4 10	1,17,574 8 3	72,114 — —	46,116 — —	1,18,230 — —
6,16,389 9 8	3,65,883 6 9	9,82,273 — 5	6,21,129 15 11	3,92,878 7 —	10,14,008 6 11	2,56,286 9 3	72,893 12 11	3,29,180 6 2	1,88,036 12 10½	93,560 3 7	2,81,597 — 5½
—	—	50,862 1 5	—	—	70,262 6 5	—	—	—	—	—	551 13 6
—	—	10,33,135 1 10	—	—	10,84,270 13 4	—	—	3,29,180 6 2	—	—	2,82,148 13 11½

P E G U.			SOUTH-EAST COAST.			T O T A L.		
Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.	Establishment.	Contingencies.	TOTAL.
<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>	<i>Rs. a. p.</i>
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	4,457 10 3	926 7 3	5,384 1 6
—	—	—	—	—	—	11,074 13 5	4,142 12 10	15,217 10 3
—	—	—	—	—	—	42,544 10 9	12,280 7 7	54,825 2 4
—	—	—	—	—	—	75,248 4 1	18,492 2 3½	93,740 6 4½
3,971 11 1	122 8 6	4,094 3 7	—	—	—	2,36,673 — 8	1,01,662 10 4½	3,38,335 11 —½
17,737 1 7	3,591 8 3	21,328 9 10	—	—	—	3,26,332 14 8½	1,34,945 7 8½	4,61,278 6 4½
22,249 4 6	4,649 13 11	26,899 2 5	—	—	—	4,00,940 1 5	1,58,072 9 9	5,59,012 11 2
32,056 10 4	13,398 3 5½	45,454 13 9½	4,076 4 6	3,758 5 2	7,834 9 8	6,32,758 8 5	3,26,585 — 7½	9,59,343 9 —½
26,379 14 1	25,831 — 9	52,210 14 10	11,609 15 11	15,413 4 11	27,023 4 10	7,11,547 6 1	3,54,747 11 1½	10,66,295 1 2½
46,120 11 9	26,425 9 4	72,546 5 1	14,729 8 8	8,774 11 11	23,504 4 7	8,93,011 2 7	5,02,892 1 3	13,95,903 3 10
63,198 15 3	31,002 10 —	94,201 9 3	15,012 7 5	2,668 12 7	17,681 4 —	9,36,399 14 0	3,65,585 9 2	13,01,985 7 11
2,11,714 4 7	1,05,021 6 2½	3,16,735 10 9½	45,428 4 6	30,615 2 7	76,043 7 1	42,70,988 7 1½	19,80,332 15 11	62,51,321 7 —½
—	—	13,613 14 5	—	—	—	—	—	2,66,370 2 10
—	—	3,30,349 9 2½	—	—	76,043 7 1	—	—	65,17,691 9 10½

The following exceptional charges being chiefly for working have not been included in the above expenditure, though charged against the Indian Telegraph, not having been incurred on its account:—

1856-1857—Expenses were incurred by this Department on account of an establishment for the Persian Expedition

1857-1858—Expenses were incurred by this Department on account of an establishment for the Persian Expedition

TOTAL - - - Rs.

Rs. a. p.
3,383 15 9
2,866 14 10
6,250 14 7

Add, Amount of expenses incurred by the Store Branch of the Director General's Office during the year 1861-62, which could not be properly distributed to Circles - - -
Ditto by the Printing Branch during ditto - - -

14,844 — — 86,892 4 9 1,01,736 4 9
6,856 8 9 8,405 12 4 14,762 5 1
GRAND TOTAL - - - Rs. 66,34,190 3 8½

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.

STATEMENT (D.)—continued.

SUPPLEMENTARY STATEMENT showing the EXPENSES incurred on account Working and Maintenance of TELEGRAPHS in India, during the Year 1860-61 and 1861-62.

N. B.—These amounts were paid direct from the Treasuries, and were not entered in the Cash Accounts of the Superintendents of Circles.

CIRCLES.	1860-61.				1861-62.				TOTAL.			
	Establishment.		Contingencies.		Establishment.		Contingencies.		Establishment.		Contingencies.	
	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.	Rs.	a. p.
General Superintendence -	1,500	-	-	-	1,500	-	-	-	2,662	9 3	-	-
Bengal -	-	-	2,150	-	-	-	105 10	1	-	-	2,295	10 1
North Western Provinces and Punjab	-	-	-	-	-	-	5,577	15 6	-	-	5,577	15 6
Bombay -	-	-	2,100	-	-	-	5,250	7 4	-	-	7,350	7 4
Madras -	-	-	-	-	-	-	4,774	1 8	-	-	4,774	1 8
East Coast -	-	-	-	-	-	-	284	15 9	-	-	284	15 9
Central India -	-	-	-	-	-	-	1,299	7 9	-	-	1,299	7 9
Indore -	-	-	-	-	-	-	21	1 8	-	-	21	1 8
Seind -	-	-	-	-	-	-	-	-	-	-	-	-
Dacca -	2,020	12 6	1,609	9 4	-	-	150	8 -	2,029	12 6	1,760	1 4
Pegu -	-	-	-	-	-	-	-	-	-	-	-	-
South East Coast -	-	-	-	-	-	-	-	-	-	-	-	-
Stores and workshop -	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL - - - Rs.	3,529	12 6	5,599	9 4	9,420	5 10	17,464	3 9	4,692	5 9	23,383	13 1
										28,056		
										2 10		
Deduct, Value of Departmental Service Messages included in the contingent charges of 1861-62 of the former Statement, but not credited under the Head of Receipts -										10,139		
										2 9		
										Rs.		
										17,917		
										- 1		

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.Calcutta, }
7 April 1863.

(E.)—STATEMENT of the Number of MILES of TELEGRAPH LINES and STATIONS open in each Year from the Official Year 1850-51 to 1861-62, both inclusive.

YEAR.	Bengal.		North-West Provinces and Punjab.		Bombay.		Madras.		Indore.		Scinde.		Pegu.		South East Coast.		Dacca.		Central India.		East Coast.		TOTAL.	
	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.	Number of Miles.	Number of Offices.
1850-51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1851-52	82	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	6
1852-53	83	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83	6
1853-54	91	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91	7
1854-55	2,131	31	-	-	641	10	483	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,255	48
1855-56	575	13	1,739	18	671	10	650	10	-	-	-	-	216	5	-	-	-	-	-	-	-	-	3,851	56
1856-57	575	13	1,739	18	715	11	686	12	-	-	-	-	216	5	-	-	-	-	231	3	-	-	4,162	62
1857-58	970	16	1,306	14	966	18	774	12	453	7	-	-	311	7	-	-	-	-	231	3	714	5	5,725	82
1858-59	1,140	20	1,500	20	1,239	18	1,038	15	453	7	694	11	404	8	290	2	110	1	1,267	11	958	9	9,093	122
1859-60	1,700	25	1,500	20	1,248	18	1,038	15	708	7	766	10	404	8	290	2	488	3	1,267	11	1,027	12	10,436	131
1860-61	1,749	23	1,575	20	1,238	21	1,122	16	735	8	784	10	538	9	242	3	619	8	1,275	10	1,153	17	11,030	145*
1861-62	1,749	23	1,575	20	1,238	21	1,122	18	735	8	784	12	538	8	242	-	619	8	1,275	11	1,153	15	11,030	144*

* These include nine offices occasionally opened.

C. Douglas, Lieutenant Colonel,
Director General of Telegraphs in India.

Calcutta, }
20 March 1863. }

STATEMENT of the entire EXPENDITURE in *England* on account of ELECTRIC TELEGRAPHS in *India*; viz., on purchase of Stores, Freights, Instruction of Assistants, Passage Money, &c.

											£.	s.	d.
In the year	1852-53	-	-	-	-	-	-	-	-	-	30,475	12	1
"	1853-54	-	-	-	-	-	-	-	-	-	48,215	18	11
"	1854-55	-	-	-	-	-	-	-	-	-	1,871	13	-
"	1855-56	-	-	-	-	-	-	-	£.	50 7 -			
	Recoveries	-	-	-	-	-	-	-		65 15 9			
										£. 15 8 9			
"	1856-57	-	-	-	-	-	-	-	£.	43,997 7 5			
	Less Recoveries	-	-	-	-	-	-	-		46 1 1			
											43,951	6	4
"	1857-58	-	-	-	-	-	-	-	£.	114,365 7 9			
	Less Recoveries	-	-	-	-	-	-	-		18 7 11			
											114,346	19	10
"	1858-59	-	-	-	-	-	-	-	£.	23,084 4 10			
	Less Recoveries	-	-	-	-	-	-	-		13 3 1			
											23,071	1	9
"	1859-60	-	-	-	-	-	-	-	-	-	2,014	10	2
"	1860-61	-	-	-	-	-	-	-	-	-	25,598	14	4
"	1861-62	-	-	-	-	-	-	-	-	-	95,869	15	6
										£.	385,415	11	11
Less Recoveries in 1855-56 in excess of Expenditure	-	-	-	-	-	-	-	-			15	8	9
										£.	385,400	3	2

India Office, }
19 May 1863. }

W. T. Thornton, Secretary,
Public Works Department.

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EAST INDIA (OUDE CLAIMS).

RETURN to an Address of the Honourable The House of Commons,
dated 27 April 1863;—for,

“COPY of any DESPATCH from the Secretary of State for India to the Governor General of India, directing him to appoint a COMMISSION for the Re-investigation of the Cases of the CLAIMANTS against the late STATE of OUDE.”

India Office, }
28 April 1863. }

J. HAWKINS,
Secretary, Judicial Department.

COPY of DESPATCH from the Secretary of State for India to the Governor General of India, directing him to appoint a COMMISSION for the Re-investigation of the Cases of CLAIMANTS against the late STATE of OUDE.

(Judicial, No. 22.)

To his Excellency the Right Honourable the Governor General of India in
Council.

My Lord,

India Office, London, 28 February 1863.

PARA. 1. I now proceed to reply to the Despatches of your Government, in the Foreign Department, Nos. 141 and 14, dated respectively 7th September 1861 and 22d April 1862, transmitting the reports of Sir Barnes Peacock and Mr. Baillie on the claims of Mr. Frith and others on the late Native Government of Oude; and to communicate to your Lordship in Council the instructions of Her Majesty's Government in regard to the course which, in their opinion, should now be taken with the view of bringing these claims to a final decision.

2. Sir Barnes Peacock, after an elaborate investigation into some of these claims, expressed his opinion that the British Government was, neither morally nor otherwise, under any obligation to discharge them, and it was intimated to Mr. Frith, in Mr. Melville's letter of 29th July 1859, that Her Majesty's Government saw no reason to doubt the propriety of this decision. Mr. Bailey, the extra Judicial Commissioner of Oude, arrived at a similar conclusion upon others of these claims which were submitted to his investigation. Objections, however, have been urged against both these inquiries, on the ground that the claimants were not represented before the officers who conducted the investigations, and that the inquiries can scarcely be considered as fully carrying out the assurance given to Parliament in 1858, by the Minister for India, that “these claims could best be investigated by a Commission on the spot, and that such a Commission it was proposed to appoint.”

3. I have accordingly to request that your Lordship in Council will issue a Commission for the investigation of the claims preferred by the persons named
228. in

* Mr. Frith.
Mr. Grant.
Major Darrell.
Captain Webber.
Capt. Edwardes.
Mr. Clark.
Mr. Prendergast.

in the margin,* or of such of them as may appear to prosecute their claims ; and I shall be glad to find that you can make arrangements for appointing one of the Judges of the High Court to undertake this important duty.

4. You will issue orders that public notice be given of the issuing of this Commission, and of the date of its opening, which should be fixed at a sufficiently distant day to afford such of the parties as may be in Europe ample time to appear before it, and submit their evidence. On concluding the investigation, the Commissioner will report the proceedings, together with his own opinion on the several cases, to your Lordship in Council.

5. I leave it to your Lordship to consider whether it may not be advisable to have a short Act passed by your Council for making Laws and Regulations, empowering the Commissioner to summon witnesses, to administer oaths, to call for records from public offices, and to take all such steps as may be necessary to enable him to arrive at a satisfactory conclusion respecting the several matters which may be submitted to his inquiry.

6. The Government will, of course, be represented by counsel before the Commissioner.

I have, &c.
(signed) C. Wood.



EAST INDIA (OUDE CLAIMS).

COPY of DESPATCH from the Secretary of State
for India to the Governor General of India,
directing him to appoint a Commission for the
Re-investigation of the Cases of the CLAIMANTS
against the late State of OUDE.

(*Mr. Wyld.*)

*Ordered, by The House of Commons, to be Printed,
29 April 1863.*

OUDE CLAIMS INQUIRY.

RETURN to an Address of the Honourable The House of Commons,
dated 24 July 1863;—for,

“COPY of any LETTER from the Secretary of State for *India*, to the Governor General of *India*, directing him to make Arrangements for holding the INQUIRY into the CLAIMS against the late STATE of *Oude*, at *Calcutta*, instead of at *Lucknow*, at as early a Period as possible after the 1st day of October next.”

India Office, }
27 July 1863. }

J. HAWKINS,
Secretary, Judicial and Legislative Department.

(No. 65.)

His Excellency the Right Honourable the Governor General of India in
Council.

My Lord,

India Office, 24 July 1863.

I HAVE to acknowledge the receipt of your Foreign (Judicial) Despatch, dated 8th May (No. 5) 1863, stating that a commission for the investigation of the claims on the late Native Government of Oude will sit at Lucknow, as soon as possible after the 1st February 1864. Judicial.

2. Notice has been given to the whole of the claimants, as requested in the 2d paragraph of your Despatch, with the exception of Captain Webber, whose address has not yet been ascertained.

3. I now transmit to you copies of the replies received from six of the claimants, as noted in the margin. You will observe that some of them have expressed a desire that the Commission should hold its sittings in Calcutta, and Mr. Frith is anxious that it should sit not later than October. From the information at present before me, I am not aware of any objection to a compliance with these wishes. I have, therefore, to request that, unless there is some objection to such a course, you will make arrangements for holding the inquiry at Calcutta, and at as early a period as possible after the 1st October next, so as to meet the convenience of the claimants.

Mr. Frith;
Mr. Grant;
Miss Clark;
Mr. St. B. Sladen,
Solicitor to Mr.
Prendergast;
Lady Darrell;
A. A. F. Edwards,
Esq.; and others.

4. I also transmit copy of a letter from Messrs. Gosling and Girdlestone, stating that the claim of Mr. Robert Grant is the property of their client, Mr. Warren H. L. Frith.

I have, &c.
(signed) C. Wood,

OUDE CLAIMS INQUIRY.

COPY of LETTER from the Secretary of State for *India*, to the Governor General of *India*, directing him to make Arrangements for holding the Inquiry into the Claims against the late State of *Oude*, at *Calcutta*, instead of at *Lucknow*, at as early a Period as possible after the 1st day of October next.

(*Mr. Wyld.*)

Ordered, by The House of Commons, to be Printed,
27 July 1863.

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OUDE CLAIMS (ASOPH-UL-DOWLAH).

RETURN to an Address of the Honourable The House of Commons,
dated 24 July 1863;—for,

“COPY of any MEMORIAL or STATEMENT of Mr. *Wellesley Bowes Prendergast*, Agent of the Representatives of *Monohur Doss* and *Dwarcah Doss*, commonly called ‘the Calcutta Bankers,’ respecting the CLAIM for the Payment of the PUBLIC DEBT contracted by *Asoph-ul-Dowlah*, the Vizier of *Oude*, in aid of his Subsidy to the Bengal Government, with APPENDIX thereto, presented to Her Majesty’s Secretary of State for India in Council, since the Year 1857.”

India Office, }
27 July 1863. }

J. W. KAYE,
Secretary, Political Department.

MEMORIAL of Mr. *Wellesley Bowes Prendergast*.

THE undersigned, *Wellesley Bowes Prendergast*, Agent of the present Representatives of *Monohur Doss* and *Dwarcah Doss*, commonly called “the Calcutta bankers,” begs respectfully to lay the following statement before Her Majesty’s Secretary of State for India in Council, respecting their claim for the payment of the public debt, amounting to 12 lakhs, or thereabouts, contracted in the years 1793 and 1794 by *Asoph-ul-Dowlah*, the Vizier of *Oude*, in aid of his subsidy to the Bengal Government, and of the expenses of the troops sent to *Rohilcund*, then in rebellion against both Governments.

*See Lord Brougham’s
Speech, Parl. Deb.
1834.*

1. The claim of “the Calcutta bankers” has from time to time occupied the attention of the Bengal Government, the India House, the Board of Control, the courts of law, and both Houses of Parliament; and the voluminous printed records on the subject, which are in the possession of your Honourable Council, render it unnecessary to enter into a detailed narrative of the case, or of the unforeseen circumstances and public events which have impeded the regular pursuit of it; but the claimants having perused “a copy of a letter from the Government of India to Lord Stanley, dated 17th of May 1859, with reference to certain claims upon the Native Government of *Oude*,” they are desirous of calling the attention of your Honourable Council to the following facts:—

2. The validity and purity of their claim has been fully and repeatedly recognised by both the Native and British Governments, viz.,

First. By the loans in question having been originally negotiated through Mr. Cherry, the British Resident at Lucknow, for the purposes above stated.

*See his despatch of 29th January 1795, and
the Governor General’s reply, dated 25th February 1795, approving.*

Secondly. By their having been vouched and transmitted as “just” to the Governor General by Mr. Cherry, on the 14th of April 1796.

Thirdly. By terms of compromise having been offered by Mr. Cherry’s successor, Mr. Lumsden, and rejected by the bankers, as being inferior to those granted to other British subjects.

*See Mr. Lumsden’s
despatch, dated 28th
September 1796.*

Fourthly. By the Earl of Moira’s Minute on the claim, dated 1st January 1816, in which he declares it to be “pure in origin and correct in amount.”

See App. Ext. 5.

See App. Ext. 7.

Fifthly. By the letter from Mr. Strachey, the Resident at Lucknow, to the Vizier, dated 24th October 1816, urging the payment of the claim, on the ground of its "admitted justness."

See App. Ext. 6.

Sixthly. By the Report of the Government of Bengal upon the claim, dated the 9th of November 1816.

See Mr. M. G. Prendergast's letter to the Duke of Wellington, printed by order of the House of Commons.

Seventhly. By the Vizier's reply to the Resident's appeal, dated 29th of October 1816, in which he does not attempt to impugn the validity of the debt. To which may be added the unimpeachable testimony of the Marquis Wellesley, in a letter to the Earl of Moira, dated the 3d of May 1814, and placed upon record; as also that of Mr. Joseph Hume, who sat upon the Committee of the House of Commons appointed to investigate the claim.

See his speech in Mirror of Parliament, 1834, and App. Ext. 9.

3. The securities given for these loans by the Nawab Asoph-ul-Dowlah, and now held in England by the representatives of the Dosses, were tuncachs or bonds, charged upon certain districts of Oude.

See letter of Sir John Shore (Lord Teignmouth) to the Vice President in Council, dated 21st February 1798; also evidence of Colonel Baillie. Oude Blue Book, 1856, p. 76.

4. The Nawab died in September 1797, leaving great wealth, and after a short occupation of the musnud by Mirza Alea, the latter was deposed, and Saadut Ali, the brother of Asoph-ul-Dowlah, was placed upon the throne by Lord Teignmouth, upon terms highly advantageous to the British Government.

See Paper, presented to House of Commons, 12th June 1822.

The Treaty of Benares.

N.B.—The Dosses were the only Shroffs who at this time were not settled with. See Resident's Despatch, 28th September 1796.

5. By a preliminary treaty, dated January 1798, Saadut Ali engaged to raise the subsidy to the British Government from 50 lakhs to 76, and also (Article 17), to pay the just debts of Asoph-ul-Dowlah; but by a definitive treaty, dated 21st February 1798, this Article 17, respecting the debts, was withdrawn, and the Governor General in his report states, "I informed the Nabob that, although the Article was withdrawn, it was still left to his equity to satisfy such claims as he might deem fair and just. In this class he would probably find the demands of the Shroffs" (the Dosses) "upon the Vizier."

1st January 1816. And see Lord Wellesley's letter, dated 3d May 1814.

6. Although Asoph-ul-Dowlah left at his death 44 lakhs in the Treasury, the whole was applied towards the increase of subsidy, and the expense of placing Saadut Ali on the musnud, without regard to the claim of the Dosses! and as Lord Moira observes, in his Minute upon this debt, "the Government confessedly forebore to urge the repayment of it, lest it might embarrass the liquidation of the demands it was then pressing, on its own account, upon Saadut Ali."

See Oude B. Book, 1856, p. 77 and p. 80.

7. On the 14th of November 1801, Lord Wellesley entered into a treaty with Saadut Ali, by which he obtained from him, in lieu of subsidy to the British Government, the cession of a portion of his territory, producing one crore and 35 lakhs, and which included most of the districts charged by Asoph-ul-Dowlah with the repayment of the loans advanced by the claimants.

Oude B. Book, 1856, p. 80. It is stated by Col. Baillie that he left 17½ millions in specie. See App. to Printed Case.

8. Saadut Ali died in 1814, leaving 13 millions sterling in the Treasury. He had first offered an inadequate compromise of this debt, but emboldened by a sense of impunity, he subsequently repudiated it altogether, upon the shallow pretext that he had been relieved from any obligation respecting it by the withdrawal of the 17th Article of the Treaty of Benares.

See Parl. Debates, Oude Cl. 1834.

9. The refusal on the part of the British Government to enforce the payment of this claim upon the Nawabs of Oude has been based solely upon the policy of "non-interference" with (as alleged) an independent prince.

See Art. 1, Sup.

10. But immediately upon the annexation of Oude, the memorial adverted to in paragraph 41 of the "Letter to Lord Stanley" was presented to the Bengal Government by Captain Prendergast, who subsequently was wounded and died at Agra during the mutiny.

11. Captain Prendergast was the son of Mr. Michael George Prendergast, the first agent of the Calcutta bankers, and well known by his long residence in India, and by the indefatigable energy with which, during a period of 25 years, he devoted himself to their interests, not only without remuneration, but at a sacrifice to his health and of his private resources, which caused his death.

12. The undersigned and present agent of the claimants is the only surviving son of Mr. Michael George Prendergast, and with reference to what is stated in paragraph 41 of the "Letter to Lord Stanley," namely, that the claim has been purchased by the members of his family, he will content himself with recalling the eloquent and indignant public denial of the same charge by Lord Brougham in a speech delivered by him in the House of Lords in 1834.

13. The claimants, who have never received any indemnity whatsoever, do not seek to recover the enormous amount of compound interest by which ingenious calculators have magnified this debt, and furnished a powerful argument against its settlement. They admit the question of interest to be a fair subject of compromise.

14. Upon the annexation of Oude, the President of the Board of Control stated in the House of Commons that, as in the cases of the Carnatic and Mysore, the *bona fide* and public debts of the country would be paid out of its revenue. 18th March 1857.

15. It is admitted that by the possession of the Oude territories a large surplus revenue will accrue to the British Government. This claim, therefore, which as far back as 1816, when living testimony was still at hand, was thoroughly investigated and favourably pronounced upon by three Governor Generals of India, Lord Teignmouth, the Marquis of Wellesley, and the Marquis of Hastings; by several distinguished members of Council, Mr. Edmonstone, Mr. Seaton, Mr. Dowdeswell; which was earnestly, eloquently, and publicly supported by such men as Lord Lyndhurst, Lord Brougham, Lord Plunket, Lord Glenelg, Sir Charles Wetherell, Sir Samuel Romilly, Sir John Leach, Sir James Macintosh, Mr. Joseph Hume, and many others; this claim, which has always obtained the sympathy of the highest authorities, is now once more preferred by the family of the Dosses, with a confident appeal to the wisdom, justice, and good faith of your Honourable Tribunal. Oude B. Book, 1856, p. 308.

Wellesley Bowes Prendergast.

APPENDIX.

No. 1.

EXTRACT from the DESPATCH of Mr. *Cherry*, the Resident at Lucknow, to the Governor General, dated 29 January 1795.

THE minister had replied to my demand for money, that he could not furnish any. Accordingly, with the sanction of the minister to the terms, I lent my credit for a sum, borrowed of the house of Monohur Doss, whose gomastah, like many other Shroffs, had refused to trust Tickait Roy.

No. 2.

EXTRACT from the REPLY of the Governor-General to the above, dated 25 February 1795.

I APPROVE the measures which you have adopted for providing funds for the exigencies of the troops, &c. &c. &c.

No. 3.

COPY of Mr. *Thornton's* Letter to Lord *Moir*.

My dear Lord,

India House, 3 March 1814.

AMONG the many subjects which have occupied the attention of the Court, there is one in particular to which I am very anxious to call the attention of your Lordship. It is a memorial from Monohur Doss and Seetul Bahoo, who are bankers at Calcutta, which has recently been submitted to us by Mr. Prendergast.

Seetul Bahoo was the widow of Dwarcab Doss.

On this memorial the committee of correspondence have resolved, that it would not be proper to go so far as to recommend the case to the Bengal Government for an interference with the Vizier. During the discussions I found that the grounds which influenced the committee, and which occasioned that resolution, were chiefly the following:—

1. Because it is the peculiar province of the governments abroad, and of the Bengal Government in the present instance, to decide questions and redress grievances of this nature.
2. Because the proposed recommendation, issuing from the authorities in this country to the Bengal Government, would carry with it the appearance of reprimand for neglect of duty.
3. Because it appears surprising, that a case representing so much oppression and injustice towards the memorialists, and stating that repeated opinions had been recorded by preceding governments in Bengal in favour of the justice of their claims, should have remained the whole period of Lord Wellesley's government neglected and undecided upon.
4. Because it is contrary to the practice of the Court of Directors to entertain memorials of this nature, unless transmitted through the governments abroad.
5. Because the proposed recommendation might involve the East India Company in a legal responsibility to the claimants, in case the Vizier refused to discharge the debt.

The deputy, myself, and several other directors could not concur in the opinion of the majority of the committee, which of course swayed the Court. We thought that, on public grounds, the memorialist had a decided claim on the justice and equity of the Company, and should have been glad officially to have called for your Lordship's interference.

Mr. Robinson, who was secretary to Lord Cornwallis, professed his opinions publicly in Court, from his having investigated the subject with every attention, and fully agreed with us in the propriety and justice of the claims of the bankers, and in the fitness of addressing your Lordship to give your strongest interference. However, the matter was pressed no further, and no public letter will be written to you.

I conceive, however, that the character of the Company is interested in this business, and under such a conviction I am very anxious to communicate the case to your Lordship, in the hope that it will receive that favourable consideration which it seems so well to merit. This anxiety, I am free to confess, is increased by the private friendship which I bear to Mr. Prendergast. This, however, is a minor point, which would not be alluded to, were it not for the public view I take of the subject.

It having been decided not to recommend the application to the Bengal Government, for the reasons stated, I have it only in my power privately to communicate to your Lordship my ideas on the business; and I beg to assure you, that if your Lordship can consistently take the same view of the claims of the memorialists which I do, and interfere on their behalf with the Nabob Vizier, I shall be highly gratified; convinced as I am that your Lordship will thereby materially assist the memorialists in the adjudication of a claim founded on every sense of justice.

With sincere regard, I remain, &c.

To his Excellency the Earl of Moira,
Governor General, &c.

(signed) *Robert Thornton.*

No. 4.

LETTER from the Marquis *Wellesley* to the Earl of *Moira*, and placed by him on Record.

My dear Lord,

Apsley House, 3 May 1814.

UNDERSTANDING that your Excellency will receive by this Despatch an application from Mr. Michael George Prendergast, agent to Monohur Doss and Seetul Bahoo, bankers at Calcutta, representing their claims upon the justice and honour of the Company's Government, I think it my duty to trouble you with my sentiments on this case, which came under my particular observation in Bengal.

The details of the case are fully stated in the memorial and in other documents, which will of course be submitted to your Excellency's judgment; it will therefore be sufficient for me to assure you, that after full consideration of the whole matter, my decided opinion was that the memorialists were entitled, in justice and equity, to the full amount of their claims, and that it was the duty of the Supreme Government to urge the demand on the Nabob of Oude with all the force which the delicacy of such question might admit.

The principal point which I am anxious to explain, is the cause of my silence on this subject during my administration in India. Inferences might be drawn adverse to the claims of the memorialists, or injurious to my sense of justice, from a circumstance which is in reality to be attributed to the very peculiar state of affairs during my government,

government, and to the uninterrupted train of extraordinary events which occurred during that period of time.

The truth is, that those events and their consequences so entirely occupied my attention, as to leave me little time for the prosecution of claims of a private nature; and particularly with regard to the state of Oude, my discussions with the Nabob Vizier on other points of the most arduous nature precluded the possibility of preferring matter, however weighty in the scale of justice, of inferior consideration in a political and national view.

But I repeat to your Excellency my entire conviction of the strength of this claim, and the propriety of urging it upon the consideration of the Nabob Vizier, who, I trust, will be induced to discharge so clear a debt of honour, especially as it stands absolutely distinct from any other demand of any other creditor of the State of Oude.

His Excellency the Earl of Moira, K. G.
&c. &c. &c.

I am, &c.
(signed) Wellesley.

No. 5.

The Earl of *Moira's* Minute on the Bankers' Claims, dated 1 January 1816.

ON a consideration of the bankers' case (as this application has been distinctly termed) the following points present themselves:—

That the bankers in question, though not Europeans, were British subjects, and as such entitled to the good offices of Government.

That the debt which they claimed of Asoph-ul-Dowlah was admitted to be just, both as to purity of origin and as to amount, by the Nabob Vizier and by the British Government.

That the liquidation of it was thence recommended in the settlement of the Nabob Vizier's affairs.

That the bankers could not vitiate the quality of their demand, by declining to accept a composition, which they suspected to have been brought forward for the purpose of exacting sacrifices from some of the creditors, while others were to receive prompt and full payment.

That the Government did not consider them as having forfeited claim to its mediation by declining that composition; but, as will appear from the Marquis Wellesley's letter, did subsequently countenance their application.

That there was a fair implication of equitable reliance on the good offices of Government, inasmuch as the money borrowed from the bankers was known to be taken up for the purpose of discharging the arrears due to the Honourable Company, a circumstance which, though it affords no legal tie, appeals directly to one's feelings, whether the bankers must not have been influenced by an ulterior confidence in the protection of Government, with regard to a loan whence Government was to draw a material convenience, and which was therefore agreeable to it.

That this implication is much strengthened when one adverts to the extent and notoriety of intercourse between the Government and Asoph-ul-Dowlah in pecuniary concerns.

That in fact there was that sentiment acknowledged by Government relative to this loan; but Government confessedly forebore to urge the repayment, lest it might embarrass the liquidation of the demands it was then pressing on its own account upon Saadut Ali.

That these circumstances take the bankers' case completely out of the class of those demands respecting which the Honourable Court has precluded the intervention of Government; this case not being the simple transaction between individual and individual, against which the Court has established the bar; but a claim heretofore recognised as just by Government, and only suffered to sink through the avowed preference which we gave to our own interest.

That by the letter from Mr. Thornton, it is indisputable the Court has put this construction on the bankers' case, and has been withheld from recommending it to the consideration of Government, only from the principle that the judgment to be passed on such questions ought to rest with the local authorities.

On this ground I think the petitioners entitled to all the assistance which we can with propriety afford them. Unfortunately that does not go far. We cannot bring forward the claim to the Nabob Vizier as one which the Government formally supports, because we should have difficulty in vindicating our right of application should he resist it; but I think Mr. Strachey may be instructed to take advantage of some favourable opportunities for stating the demand as one which it would be creditable to the justice and honour of his Excellency to liquidate.

No. 6.

From the Government of Bengal to the Court of Directors, dated 9 November 1816.

To the Honourable the Court of Directors for Affairs of the Honourable the United Company of Merchants of England trading to the East Indies.

Honourable Sirs,

THE object of the present address is to bring under the notice of your Honourable Court the proceedings which we have held on a memorial from Monohur Doss and Seetul Bahoo on the subject of their claims against the Government of Oude, as submitted for our consideration by Messrs. Fergusson and Clarke, agents for Mr. Prendergast, the agent and attorney for the memorialists in England.

2. Those claims your Honourable Court is aware, were submitted by Mr. Prendergast for your consideration; and it appears by the letter from the agents here, that your Honourable Court declined interference in the first instance, on the ground that the subject was one which was properly cognizable by the local Government.

3. This case was not new to this Government, as your Honourable Court will observe from the enclosed copy of a letter received from the Governor General from the Marquis Wellesley, from which it appears that the claim in question was viewed by Lord Wellesley as deserving the consideration and support of the Government, which it would have received during his Lordship's administration, but for the causes assigned in his Lordship's letter.

4. It appeared to us, on a consideration of the memorial in question, that although the British Government could not be warranted in formally supporting the claim of the bankers against the Government of his Excellency the Nabob Vizier, yet, with advertence to the admitted justice of it, and to the circumstances under which the debt was contracted by the late Asoph-ul-Dowlah, the bankers were entitled to the good offices of this Government, to the extent of our authorising the British Resident at the Court of Lucknow to take advantage of some favourable opportunity of presenting the case to the Nabob Vizier, and stating the demands as one which would be creditable to the justice and honour of his Excellency to liquidate.

5. In the instructions which we accordingly issued on the subject to Mr. Strachey, we took occasion to state some observations on the merits of the case, for the purpose of apprising him of the general view of it taken by us, and of enabling him to make the previous statement to the Vizier, and to discuss the question under that view, should his Excellency be disposed to entertain the claim.

6. We observed that the bankers in question, though not Europeans, were British subjects, and as such entitled to the good offices of Government. *The debt which they claim from Asoph-ul-Dowlah was admitted to be just, both as to purity of origin and as to amount, by the Government of Oude and by the British Government, and thence the liquidation of it was recommended in the statement of the Nabob Vizier's affairs.* The bankers, it was observed, did not vitiate the quality of their demand by declining to accept a composition, which they suspected to have been brought forward for the purpose of exacting sacrifices from some of the creditors, while others were to receive prompt and full payment; nor did this Government consider them as having forfeited claim to its mediation by declining the proffered composition.

7. We further take occasion to observe, that there was a fair implication of equitable reliance on the good offices of Government, inasmuch as the money borrowed from the bankers was known to be taken up for the purpose of discharging the arrears of subsidy due to the Honourable Company, a circumstance which, though it offered no legal tie, gave reason to suppose that the bankers were influenced by an ulterior confidence in the protection of Government, with regard to a loan whence Government was to draw a material convenience, and which was therefore agreeable to it; this implication, too, it was remarked, was much strengthened when advertence was made to the extent and notoriety of intercourse between this Government and the late Nabob Asoph-ul-Dowlah in pecuniary concerns.

8. We have since received Mr. Strachey's Report of his proceedings under the instructions, of which the substance has been here stated.

9. From that Report, a copy of which, together with the copies of our proceedings of the 20th of April last, including the memorial of the bankers, the letter of Messrs. Fergusson & Clarke, and the instructions to the Resident at Lucknow, is annexed to this address for the convenience of bringing the whole subject into a connected form, under the review of your honourable Court; it will be seen that his Excellency the Nabob Vizier has declined all concern with the claims in question.

10. Under this positive declaration of the Nabob Vizier not to entertain the claim, we do not consider ourselves warranted in pressing the claim further on his Excellency's attention,

attention, without the express sanction of your honourable Court, for whose consideration and orders the case is now submitted.

We have, &c.
(signed) *Moir.*
N. B. Edmonstone.
Arch. Seton.
G. Dowdeswell.

Fort William, 9 November 1816.

No. 7.

EXTRACT of a LETTER from the Resident of Lucknow, to his Excellency the Vizier, urging the Payment of the Bankers' Claims; dated 24 October 1816.

I BEG leave to remind your Excellency, that the justness of the claim is entirely admitted by the British Government, which, with its usual solicitude for your Excellency's honour and credit, and the splendour and prosperity of your Government, cannot but grant its support to its own subjects, in directing your Excellency's attention to this call on your justice.

(signed) *R. Strachey*, Resident.

No. 8.

COPY of the OPINION of the late Attorney and Solicitor General on the merits of the Bankers' Case.

WE are of opinion that the constituents of Mr. Prendergast cannot obtain relief against the East India Company, by any action or suit, in any court of law or equity in this country; but we think their claims upon the Company so strong, upon general principles of equity, as to justify the interposition of any authority that can be legally and constitutionally exerted in their favour.

(signed) *J. S. Copley.*
Chas. Wetherell.

Serjeant's Inn, 6 May 1826.

No. 9.

EXTRACT from the SPEECH of the late Mr. *Joseph Hume*, during the debate in the House of Commons upon this Claim in 1834.

THIS is not a new subject to me. I sat upon a Committee of this House, 12 years ago, when the whole of the circumstances were investigated, and I am only surprised that the matter has not long since been settled. I speak from the evidence given before that Committee, and I regret that the Right Honourable Gentleman, the president of the Board of Control, has not laid before the House the whole of the evidence then adduced.

OUDE CLAIMS (ASOPH-UL-DOWLAH).

COPY of MEMORIAL of Mr. Wellesley Bowes Pendergast, Agent of the Representatives of Monohur Doss and Dutarrah Doss, commonly called the "Calcutta Bankers," respecting the Claim for the Payment of the Prarie Dearr contracted by Asoph-ul-Dowlah, the Vizier of Oude, in aid of his Subsidy to the Bengal Government, with Appendix thereto, presented to Her Majesty's Secretary of State for India in Council; &c.

(*Sir Brooke Bridges.*)

*Ordered, by The House of Commons, to be Printed,
27 July 1863.*

524.

Under 1 oz.

EAST INDIA (CAPTAIN FRITH).

RETURN to an Address of the Honourable The House of Commons,
dated 4 June 1863;—for,

- “ COPIES of a LETTER from the Government of *Bengal* to Captain *Robert Frith*, recalling him from the service of the Nabob of *Oude*, dated sometime in 1786 :”
- “ Of all PAPERS and PROCEEDINGS connected with the CLAIM of Captain *Robert Frith*, on the Nabob of *Oude*, which were before the Council at *Calcutta* in the Year 1785 :”
- “ Of all CORRESPONDENCE between Captain *Robert Frith*, Colonel *Collins*, Military Secretary to the Governor General, and Mr. *Edmonstone*, Persian Secretary to the Governor General of *India*, between the years 1785 and 1795, relating to the appointment held by Captain *Frith* in the service of the Nabob of *Oude* :”
- “ And, of a LETTER from the Court of Directors to the Government of *India*, dated the 17th day of June 1857, directing it to appoint a Commission to investigate and report upon the pecuniary Claims against the State of *Oude*.”

India Office, }
29 June 1863. }

J. W. KAYE,
Secretary, Political Department.

NOTE.—There is no Letter from the Government of Bengal in 1786, recalling Captain Frith from the service of the Nabob on the records of this office.

(*Mr. Wyld.*)

Ordered, by The House of Commons, to be Printed,
27 July 1863.

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PAPERS RELATING TO THE CLAIMS OF CAPTAIN FRITH ON
THE LATE STATE OF OUDE.

EXTRACT Bengal Secret Consultations, 14 June 1785.

EXTRACT MINUTE by the Governor General (no date).

I BEG leave to lay before the Board a letter which I have received from Major Palmer.

The Board will recollect the letters that are recorded in consultation, 26 April, from the Vizier and his acting minister.

I communicated to Major Palmer my dissatisfaction at the contents of these letters, which were in the nature of a charge against this Government for breach of the engagements made with the Vizier.

Such a charge was ill founded, and a simple reference to Rajah Govindram's letters is sufficient to prove it so. Rajah Govindram states it as his own opinion, that it would be agreeable to this Government, that the Vizier should, of his own accord, offer to pay the expense of Sir John Cumming's detachment. The truth is, that the Company have not funds to pay such expense, and as the detachment, which is maintained for the Vizier's service, is absolutely necessary for the security of his dominions, and has been lately of very essential use, it seems most reasonable that the charges attending it should be defrayed by his Excellency.

I hope that the Vizier's funds will enable him to do so, more especially as the reduction which has lately been effected by this Government in the allowances granted by his Excellency to the servants of the Company in his country, gives him an additional resource of more than 10 lacs of rupees per annum.

EXTRACT Bengal Secret Consultations, 24 August 1785.

EXTRACT LETTER from the Resident at Lucknow to *Edward Hay*, Esq., Secretary to Governor General in the Secret Department, dated 15 July 1785.

YOUR letter of the 28th June, I have also had the honour to receive, on the subject of the salaries and arrears claimed by the servants of the Company and others stationed in the Vizier's dominions, and the resolution of the Board which you therein communicate, to leave the affair entirely with the Nabob to settle as he may think proper. As it was a measure that was neither known or authorised by the Board, I have thought expedient to make known to such of the gentlemen as are involved in the resolution, and also to acquaint the minister, for the information of his Highness, with the determination of the Board upon the subject.

EXTRACT Bengal Secret Consultations, 8 November 1785.

EXTRACT LETTER from the Resident at Lucknow to the Honourable *John Macpherson*, Governor General, dated 25 October 1785.

I HAVE already had the pleasure to acquaint you, under date the 20th ult., of the final settlement of the crore and five lakhs of rupees, which were paid by the Nabob to the Honourable Company. I have the honour now to inform you, that

for the service of the present Jussutree year 1193, beginning the 19th of last month, and ending in September following, the Vizier and his ministers have agreed to furnish 65 lakhs of rupees, which, by the account I now enclose, you will perceive provides for all the sums that I have been directed to bring into the account with this Government, as well as the arrears to the Futteyghur detachment, the subsidy for the Cawnpore Brigade, and part of the estimate for the Futteyghur troops for the present year 1193 ; and the Vizier and his ministers approving the present mode of carrying on the business of this court with your Presidency, being sensible of its utility to both Governments, being desirous of relieving the Honourable Company from any expense when they derive at least an equal advantage from the cause of it, and to testify also their sense of your attention to their convenience in reducing the expense of the salaries, beg me to entreat you will allow them to defray the arrears and salaries of the present year to the servants of the Residency here, and allowances to the military officers, who by your orders of the 3d of May last, are entitled to receive them, the account of which I have now the honour to transmit, whereby you will perceive, that it will prove a saving to the Honourable Company of 162,164 rupees, so in fact the money that is to be paid by this Government for the service of yours for this year, will be a clear net revenue unattended with any expense or diminution.

The kist or monthly payments for the present year of 3,25,000 rupees, will be regularly paid, and which, when the arrears to the troops shall be in part or wholly liquidated, will be found, I hope, sufficient for both stations; and to enable you to pay off as much of those arrears as they can, the ministers agree to furnish over and above the regular kists whatever is possible between this time and the 15th December, a particular account of which, as well as the kist bundee itself, I shall have the honour to forward as soon as the sum can be ascertained; in the meantime I am endeavouring, with the assistance of the minister, to obtain ready money by every means in my power, to relieve the present distresses of the troops.

Estimate of Claims for 1193.

Army:	Rs.	Rs.
Arrears, Futteyghur Detachment - - - - -	11,60,000	
Brigade for 12 months - - - - -	31,20,000	
Regiment at Lucknow - - - - -	3,00,000	
Futteyghur Detachment - - - - -	17,40,000	
		63,20,000
Mirza Saidit Ally - - - - -	- -	2,00,000
Rohilla stipends - - - - -	- -	61,578
Mr. Fraser's bond and interest - - - - -	- -	1,70,000
Interest due the Shroffs - - - - -	- -	4,00,000
Contingent bills of Major Lumsdaine Gilpin - - - - -	- -	-
Captain Dinnis, &c., and arrears Resident Guard - - - - -	- -	1,29,456
Abdul Rheman Cawn's Candahar Cavalry - - - - -	- -	76,000
Batta to the Shroffs, 5. 9. 3. on the balance due them when the late Governor fixed the Lucknow Scca rupee to pass as of equal value with the Fyzabad 16 suns - - - - -	- -	71,910
		74,28,944
Lucknow Sicca Rupees - - -		

EXTRACT Bengal Secret Consultations, 29 December 1785.

EXTRACT LETTER from Lieutenant Colonel *Harper* to *Edward Hay*, Esq., Secretary to the Governor General in the Secret Department, dated 2 December 1785.

I BEG you also to acquaint the Honourable Board that this Government is supplying four lacks of rupees beyond the usual kists, to pay off the arrears at Cawnpore and Futteghur, and that I have borrowed one lac more for the same purpose. That I am also empowered to borrow as much more as will liquidate all the arrears, and that all the difficulties of this business will be at an end if the bankers at Benares would supply five or six lacks of rupees, which I would account with them for, and they would be repaid in six months, from that part of

of the supply for the present year, which will otherwise be remitted by bills of exchange. The three months of the new year 1193 furnishes as follows, which is wholly appropriated to the troops at Cawnpore and Futteyghur, except the Rohilla stipend, and one or two other inconsiderable payments:—

	<i>Rs.</i>
The kists of October, November, and December, at 3,25,000 rupees each -	9,75,000
Ready cash, paid and now paying by the Vizier's Government - - -	4,00,000
Borrowed by Lieutenant Colonel Harper, to be accounted for with the Vizier's Government - - - - -	1,07,500
Sicca Rupees - - -	14,82,500

I beg you will also be so good as to add, that my endeavours are unremitted to obtain money for the public service; that every supply is stopped to the Vizier's government, except those which cannot be withheld, and that the difficulties arise from the real scarcity of ready money.

EXTRACT Secret and Political Consultations, 2 October 1786.

THE Governor General delivers in the following Minute.

THE petition received from Mr. Fraser at our last meeting in this department has led me to apprehend that it has been sometimes the practice of this Board to interfere between his Excellency, the Nabob Vizier, and his private creditors, in a manner which, in my opinion, is highly inexpedient and improper, and unwarranted by the nature of our connexion with him. I therefore beg leave to move, that it may be resolved, that the Secretary should be ordered to convey our positive instructions to the Agent at Lucknow, that he shall not in future solicit the Vizier or his ministers for the payment of private debts; and to the accountant, that he must, on no pretence, receive any money, except on account of this Government.

(signed) *Cornwallis.*

EXTRACT Bengal Political and Secret Consultations, dated 17 August 1786, (page 253).

MINUTE by the Governor General (undated).

THE Court of Directors, in their commands in the Secret Department of the 21st September last, approve fully of the agreement that was concluded between Mr. Hastings and the Nabob Vizier in September 1784, for withdrawing the Futteyghur Detachment, and discontinuing to charge the expenses of it to the Vizier after the 1st of January 1785.

In the 8th para. of their commands upon this subject they regret that the members of the Board (Mr. Stables and I) did not concur in opinion with Mr. Hastings when the question concerning the recall of Colonel Cumming's Detachment was under consideration, as the expense of it would, before "the arrival of their orders, amount to nearly 300,000 *l.*" In the subsequent paras. of the same letter, viz., the 17th and 18th, the Court of Directors order "the Futteyghur Detachment to be continued so long as the Vizier shall deem such continuance necessary for his own safety, in which case the expense thereof must be carried to his account, agreeably to the stipulations of the Treaty of 1781; but that as soon as the Vizier shall cease to require the assistance of all or any part of the detachment, the former orders, as in paragraph 7, are to be carried into execution."

I wished to delay to the latest period of the Despatch my observations on the preceding paragraphs. Did the situation of affairs in the Vizier's country, or in its neighbourhood, admit the withdrawing the Futteyghur Detachment, I should

have anticipated the Company's wishes, and would have proposed the measure. But the Court of Directors have only to peruse Mr. Anderson's late correspondence from the Court of Scindia, and to consider the situation in which we actually stand with that formidable power; they will then immediately admit that it would be the worst policy, even if the Vizier wished it, to withdraw the troops which are on our frontier, and keep Scindia in check. The Vizier has not required their recall since the first invasion of the Seiks in January 1785.

The Company need never be alarmed that their ruling servants on the spot will become the advocates of subjecting the Vizier to the employment of an unnecessary body of the Company's troops, nor of charging his Excellency with a disproportionate share of the expense necessary to maintain our army. They should remember that in 1781 the Futteyghur Detachment was recalled, but that there was a necessity speedily for marching it back, yet at that time Scindia had made little progress in his conquests. The Mogul was not his prisoner, nor had he demanded the tribute of Bengal, nor had our minister been obliged, from causes of suspicion, to withdraw for a time from his Court.

If the rulers of the Bengal Government had not been determined to sacrifice every consideration of influence or of patronage to the public interest, they had only to execute the Company's orders literally, for which the Vizier would be happy to give military commands and appointments to those who might be recommended to him as the friends of administration. But experience has shown that a military force so constituted would be of little use for the defence of the country, though as expensive to the Nabob as the Company's troops. Another circumstance will readily occur to the Court of Directors. The Vizier has invariably taken care that he should be in arrears to the Company, and should the zeal of the Bengal Government obtain at any time more resources from the Vizier than the Company desire, it is only necessary to deduct so much from the Vizier's debt by a Special Order. While I am upon this subject, it is with sincere pleasure I reflect that, without our proposing a single measure of severity or oppression, it has fallen to my lot, as a member of this Government, to assist in realising from the Vizier's country those aids which have unquestionably supported the Company in their late distress. In December 1781, soon after my arrival in this country, I found that the effects of the treaty concluded with the Vizier at Chunar in the preceding September were likely to be of little advantage. Messrs. Middleton and Johnson were pressed to exert themselves, and before Mr. Bristow's appointment in September 1782 took effect, they remitted to the Presidency of Fort William, and paid to our troops without the provinces, Fyzabad *Rs.* 1,24,89,795. 12. 7.

Mr. Bristow, during his Residency, remitted and paid Fyzabad *Rs.* 1,65,39,544. 2. 8. The contest about the Residency ended in Mr. Hastings' realisation of a debt of 105 lacs from the Vizier. Colonel Harper's settlement of 1785 amounted for different purposes to 65 lacs. These aggregate sums were the extra relief which carried us through the expense of the late war, and the burthens it left upon our Treasury. But in a political view, the security gained to Bengal by having a proper force upon our frontier is a still greater object, and I venture to say, that had Mr. Stables and I agreed to withdraw the Futteyghur Detachment in January 1785, or to load the Company with its expense, the people in the Vizier's country would not have been relieved in a rupee of their taxes, and the quiet of the country could not have been maintained. It is not indirect reproach, but the approbation due for an honest perseverance in supporting the power and advantage of the Company that we merited by not approving of the proposal for withdrawing the detachment. The money paid to the detachment is spent in the Vizier's country without oppression of his ryots, whereas the sum which the Vizier would be charged by his ministers for an useless rabble for the defence of Rohilcund would be larger than that paid to our detachment, and that rabble would receive little or no pay, but live on plunder and the oppression of the inhabitants. It is a fact, that the only parts of the Vizier's country that have any regular protection are those within the influence of the protection of our troops.

The justice and the humanity of the Company very naturally lead them to attend to their public engagements with sacred punctuality, nor do they consider any extra aids derived from a country said to be already exhausted as a creditable or desirable aid. But they should be informed that they lose, instead of gaining, by their protection of the Vizier's country, that they are now so
situated

situated with that country that they must defend it or run the risk of losing their own; that the Vizier's troops are and ever will be incapable of defending it properly; that the expense of such troops is greater in the end, and more oppressive to the country, than the charge of our brigades, and that the real question is, whether the Company shall be at the chief expense of protecting the Vizier's country, or his minister be permitted to possess a great share of the revenues of that country.

The actual expense of the present force in the Vizier's country is by the paymaster-general's account, 3,30,000 rupees per month, or 39,60,000 rupees per annum. His debt to the Company on other grounds is considerable. The Board have released his Excellency of about 14 lacks a year which were a fund of patronage. The re-establishment of the Resident's guard, necessary from the mutinies at Lucknow, which even endangered the Vizier's life, together with the transfer of the command of the guards attached to the person of the Shahzada, from a turbulent native to Captain Sloper, are the only points creating any additional expense that have been recommended by the Board to his Excellency; these recommendations did not add to his real expenses, though they tended to strengthen the military security of his country.

The principles of my letter of the 18th February 1785, which the Company have so much applauded, I have faithfully maintained in every intercourse of this Government with the Vizier, but I wish I could add that these principles on my part had increased his attachment to the Company, or had added to the punctuality of his ministers in performing their engagements. Upon this subject I shall have much to lay before the Board soon, and for the information of the new Governor General. In the meantime I have thought it my duty to be thus explicit on a subject which does not seem to be fully understood by the Company or the Board of Control. If they please to recollect that, in November last, 12 lacks only in specie (a sum which drafts on England could not raise) were instrumental in saving the Carnatic, or in other words, that without those 12 lacks the mutinies of Fort St. George might have been fatal in their consequences; it will then be remembered that neither Mr. Stables nor I were much to blame in endeavouring to realise from Oude the greatest aids we could in January 1785, and in opposing the recall of a detachment of which the expense would have fallen totally upon the Company, while the country of their ally remained exposed to inroads that would have destroyed its revenue to a greater amount. I shall only observe, further, that had the Futteyghur detachment been recalled before Scindia had made his demand for the Bengal tribute, we should not have been in a situation for taking those speedy measures which enabled us to compel Scindia to disown his humble demand.

Ordered, that a copy of the foregoing Minute be transmitted to the Honourable Court of Directors a number in the packet now under despatch.

EXTRACT Secret and Political Consultations, 20 December 1786.

Mr. Macpherson delivers in the following Minute.

IN the letter from the Board, in the Secret Department, to the Secret Committee of the Court of Directors, dated the 11th November last, and written when I was absent on account of my sickness, I am apprehensive, from a perusal of the 30th paragraph, that the Minute which Earl Cornwallis introduced, recommending the non-interference of Government in future to obtain payment of private debts, owing by the Nabob Vizier, may be misconstrued by the Court of Directors, I heartily concur with his Lordship in the object of that Minute, and in the eventual resolution of the Board to forbid the Agent, of Lucknow from mixing the accounts of private claimants with those. But as I never, in any period of my service, or administration, moved the Board publicly, nor applied to the Nabob privately, to discharge a debt to any individual; and as the claims of Mr. Fraser, which brought on the proposition of the Governor General, were mixed with the public accounts by order of my predecessors in office, so I request that the Board will be pleased to take notice of this circumstance in their secret letter to the Secret Committee; a reference to the records will show clearly that

Mr. Macpherson's
Minute.

I never moved the Board to admit a private claim of any of the Nabob Vizier's private creditors to be admitted with the Company's claims, the claims of the Company's officers serving in the Vizier's country, and allowed specific sums for contingent expenses incurred in the Vizier's service, are of a different nature, and should never in my opinion be passed, but by the Board, and audited in the department where military contingent disbursements are audited, after which, those that are admitted should be added by express order of the Board to the claims against the Vizier, the claim of Lieutenant Colonel Peter Murray could not but be referred to the Vizier's ministers, and the orders of the Board were very guarded upon the subject. It was for an inconsiderable sum, and for services officially performed.

The claim of Mr. Plowden was stated to the Board upon oath, and for property sold to the Vizier; that circumstance entitled it to a preferable attention to any other private claim that was at any time announced to us, but no order passed, nor even recommendation to the President to recover its amount.

Being upon this subject, and fully impressed with the propriety and dignity of the resolution proposed by Earl Cornwallis, against interference for the recovery of private claims from the Vizier, I cannot but express a wish that all British subjects who have any demands upon the Vizier, by bond or otherwise, should be called upon to state them by a particular day, and these claims should afterwards be stated to the Company, for their directions concerning their final adjustment.

Notice might be published to all persons concerned, relative to this determination of Government, and no British subject could, after such a prohibition, have the least pretence to solicit the interference of this Government in favour of their claims upon, or their transaction with, the Vizier.

A similar regulation, if early adopted, and put in force by the Company, would have prevented all the trouble they have had relative to the debts of the Nabob of Arcot; nor do I know if any other arrangements can secure the Governor General for the time from vexatious solicitations relative to claims and debts due by the Vizier.

Agreed, that the substance of the first part of Mr. Macpherson's Minute be mentioned to the Honourable Court of Directors by the ship under despatch, and that the proposition contained in the latter part of it, do lie for consideration.

(signed) *Cornwallis.*
John Macpherson.
Chas. Stuart.

EXTRACT Secret and Political Consultations, 22 December 1786.

THE Governor General delivers in the following Minute.

The Governor
General's Minute.

I SHOULD, in any case, be sorry to have my intentions misconstrued by the Court of Directors; but it would give me particular concern if any part of the conduct of my predecessor in office should be affected by such misconstruction. I cannot, therefore, have the smallest objection to comply with Mr. Macpherson's wishes, that the explanation which he gives of the line that he pursued in regard to the claims of individuals upon the Vizier shall be stated in our next General Letter in the Secret Department. A strict adherence to our general resolution against all future interference of that kind will, I am persuaded, be found useful and creditable to this Government, and as the principles upon which that resolution was founded will soon be generally known, I cannot say that I apprehend much inconvenience from private solicitation. I think it very possible that individuals, who know that they cannot succeed here, will try the fate of similar applications to the Court of Directors; but as I will freely confess that the reasons which actuated us should in my opinion lose none of their force with the Honourable Court, it would not be justifiable in me to recommend the measure of calling for and stating a list of the private debts of the Nabob Vizier to British subjects. It would most reasonably be construed into an implied intention of giving assistance to recover them, and would directly contradict the declaration that I have given on the proper line for the future conduct of the Government.

Mr. Macpherson.

THE ideas which I suggested, relative to the ascertainment of private claims from British creditors against the Nabob Vizier, were to relieve the Governor General particularly, and the Company in future, from any applications on similar subjects. Whatever appears best to the Governor General, after the circumstances which I have stated, cannot but meet my wishes.

Mr. Macpherson's
Minute.

EXTRACT Bengal Political Consultations, 27 June 1792.

EXTRACT LETTER from the Resident at Lucknow to Earl Cornwallis, Governor General; dated 10 June 1792.

2. THE Rajah said that all the demands of every kind against the Nawab could not be much less than a crore of rupees; that an account of the Hustabood of the country was nearly prepared, which he would show to me as soon as finished; that it was absolutely necessary some system should be adopted, and not departed from, by which his Excellency should so limit his expenses as to secure a provision—firstly, for the regular discharge of the Company's subsidy; secondly, for defraying the necessary expenses of Government; and thirdly, of a gradual liquidation (which he was ready to admit could not be done in the course of one year) of the claims above mentioned.

EXTRACT Bengal Political Consultations, dated 9 October 1795.

(No. 30.)

EXTRACT LETTER from the Resident at Lucknow, to Sir John Shore, Bart., Governor General; dated 23 September 1795.

10. ALTHOUGH the above paragraph relative to the army formed one of the particulars entrusted to my communication, yet another will be found in the enclosed translation of a letter addressed to me by his Excellency. Although the Vizier, in the plan of government which he delivered to me, declared that he will pay the debts due by his Government, and the answer to that part of the plan which I delivered in, and have corroborated by agreement, elucidatory of the inestimable value of justice, might be considered sufficient grounds for me to address you on this subject without the written application made to me by his Excellency; yet, sensible that these debts have no concern with your Administration further than the discharge of them will contribute to establish the credit of your ally, and aware that the demands are considerable, I thought it my duty to obtain the application for your assistance under his Excellency's seal; and with the view of putting a stop, as far as lies in my power, to the evasions which I apprehend, in matters of this nature, will be made, if not by Tickait Roy at least by those who under him were in charge of the treasury, and are said to have large sums of private property invested in the funds, I suggested that the spirit of the order to Tickait Roy might be expressed in the letter, as well as a declaration that funds should be allotted for the discharge of the debts as soon as they can be ascertained.

11. As the wisdom of Government has thought proper to enjoin a decided line of non-interference on the part of your Resident in the debts due to individuals, whether Europeans or Natives, except in transmitting the applications and forwarding answers to them, I have confined myself to the injunction in such applications as have, owing to the change which his Excellency made in taking the treasury into his own charge, been lately made by Europeans.

12. While informed of the particulars of these debts only on grounds which will not enable me to lay them before you as authentic, I am compelled to be silent on the principal points which are necessary for your information, in the event that you may think proper to delegate any power to me in this respect. But I cannot help observing that, whatever may be his Excellency's disposition to discharge these debts, the inquiry into them may, unless invigorated by the influence of the English Government, be subject to intrigues and delays highly injurious to his Excellency's dignity, to the credit of his Government, as well as ruinous to the unsupported individual who has been led, by practice long established under mismanagement,

to place his property in the funds, and oftentimes by hopes of obtaining trifling patronage, in the pursuit of commercial concerns, from the ministers; whose pernicious system of providing for the exigencies of Government by loans too frequently compelled them to seek this fleeting assistance from any whose situation made them court favour by such means, and whose ignorance of the tottering political state of the finance of this Government did not permit them to see the danger to which they were about to expose their property.

13. Under this idea, I beg leave to remark that your authority to acquiesce in his Excellency's request will be sufficient for the present, should you think proper to contribute so much towards the dignity and reputation of this Government, and to honour me with so important a duty: at the same time I humbly offer my services, with the earnest hope that the decision on the debts may be pronounced final only on your confirmation of, and sanction to, the report which may be transmitted to you, under the attestation of the parties concerned, or their representatives; so that I may not be hereafter considered in any shape responsible, but to the Power which delegates the authority to me for the pursuit of an inquiry beneficial, perhaps, to the Company only in the secondary degree, and to me in no respect whatever, except in the credit which I hope to attain for impartiality and a zealous desire to discharge my duty.

(No. 31.)

TRANSLATION of a LETTER from His Excellency the Vizier to the Resident at his Court. (Received 19 September 1795.)

I AM so convinced of the friendship of the Governor General, and so sensible of your exertions and desire to strengthen that intimacy between two Governments, which, by the blessing of God and the unanimity that prevails, must increase daily, that by the assistance of Providence, and the advice and counsels of the Governor General, conveyed through your zeal and great exertions, the affairs of my Government, which have for years been declining, will be put in order, and my Government become flourishing.

Aware that the practice of supplying the exigencies of Government by borrowing money was a source of this decline, and had brought upon the State very great distresses, I took the management of my treasury into my own hands, in order to put an end to this practice, and directed that no disbursements should be made but from my treasury. Although I was before acquainted with the particulars of the debts, yet, from applications which have been made to me by the creditors, I observe that large sums have been lent to my Government by Europeans. "Do justice" and a good name are strong supports to a Government; my desire is that the debts be inquired into and ascertained, and that the just ones be put in train of payment. Placing great confidence in the friendship of the Governor General, I wished that he should be kind enough to interest himself in the debts of my Government. I am happy and pleased with the replies and communications which you have made to me from him: I am in the highest degree obliged to him, and pleased with your friendship. I have directed Rajah Tickait Roy to prepare the accounts of the debts due by my Government to Europeans and to Natives, and to report the particulars to you. I request that you will ascertain the true and just debts, and report the same to the Governor General, who will be pleased to communicate his sentiments to you for my information. I am now going on my usual hunting excursion, and I shall, at the same time, see the state of my country. I have, by the blessing of God and the kind aid of the Governor General, established my Government on a new system; and when the amount of the just debts, which are a heavy burthen on my Government, shall be known, I will inform you of the plan for paying them, which you will communicate to the Governor General.

(No. 32.)

THE following letter, approved by the Board, is written to the Resident at Lucknow by the Governor General:—

To *G. F. Cherry*, Esq., Resident, Lucknow; dated 9 October 1795.

Sir,

I HAVE received your letter of the 23d ultimo. My reply will be confined to two subjects which require remark—the arrangements of his Excellency's army, and the liquidation of his debts.

With respect to the first, I cannot but express my regret that, for any reasons, any arrangements so indispensably necessary to the independency of his Excellency and the security of his dominions should have been deferred; and I must therefore recommend that, after his Excellency's return to Lucknow, you point out

out to him, in the strongest terms, the obvious dangers attending a delay in reforming his military establishments. You can be at no loss for arguments to support a proposition which looks to the security of the Vizier, and I have no hesitation in urging his exertion towards objects of such magnitude and importance.

Under the cautionary suggestions in my former instructions, which you have already received, respecting the just demands upon the Vizier, I can have no objection to affording his Excellency the assistance of your interference in promoting an adjustment of those demands, or, if necessary, of giving my sentiments upon it when prepared. I accordingly authorise you to comply with his Excellency's application—viz., to ascertain the true and just debts, with a view to their being put into a train of payment.

I am happy to learn that his Excellency's absence is not likely to occasion any interruption to the prosecution of the arrangements on foot.

EXTRACT Bengal Political Consultations, dated 23 November 1795.

(No. 29.)

EXTRACT LETTER from the Resident at Lucknow, to Sir *John Shore*, Bart., Governor General. (No date.)

6. ON being honoured with the receipt of your commands of the 9th October, I addressed his Excellency (No. 2), and on the arrival of Rajah Tickait Roy and Butchraje, I received the accompanying letters from his Excellency (Nos. 3 and 4). The reference made by his Excellency to the verbal communications of Rajah Butchraje, and the sincere declarations contained in those letters, that the debts are to be put into a train of payment, induced me to confine my conversation with him, for the present, to the debts only. He informed me that it was his Excellency's wish that I should examine the accounts of the debts, which would be delivered to me by Tickait Roy, and in the investigation into the debts extend my inquiries, as far as might appear necessary, into the Jumma Khurch accounts of the Government. I do myself the honour to lay before you a general statement of the debts, as delivered to me by Tickait Roy. The very appropriations of their amounts, and the indefinite items under which they are placed in this statement, appear at present to demand that an examination of the Jumma Khurch accounts of the periods of the accumulation of the debt should take place, before it can be expected that the Vizier will provide funds for their discharge.

7. I am informed by Rajah Tickait Roy, that notwithstanding the declared appropriation of the amounts of these debts to the expenses of the Sirkar, &c., there are arrears due—to the various departments of the Government, the Tunkawdar pensioners, the troops, the Prince, and other regular demands—of near 75 lacs more. Tickait Roy has promised to deliver me this account in a day or two, and has engaged to his Excellency that the Jumma Khurch accounts of his own Administration shall be ready for his Excellency's and my inspection by his return to Lucknow.

8. Meaning to call on Tickait Roy for the detailed accounts of the debts comprised in the accompanying statement, and on receipt of them to demand the accounts from the creditors, I shall beg your permission to transmit for your information separate journals of my proceedings on this subject, to divide my investigation into two heads—one, the inquiry into the claims of the creditors on the State; and the other, how far the claims are in justice to be answered by his Excellency, or have arisen from a combination between the creditors and the executive officers of the Government, being informed by Rajah Butchrajee that on an examination into the Wassil Bakhy accounts of the last year's revenues at Fyzabad, no arrears are due from the country.

(No. 31.)

LETTER from the Resident at *Lucknow* to the Vizier; dated 24 October 1795.

I was honoured with your Excellency's letter prior to your departure from Lucknow; *vide* letter received 19th September 1795.

Having transmitted your Excellency's commands for the information of the Governor

Governor General, I am directed to express his satisfaction at your Excellency's determination to investigate the debts due by your Government, and to place those which are just in a train of payment. The Governor General, anxious not only for the prosperity of the affairs of your Government, but equally so for the reputation of your Excellency's family in the eyes of the Powers of Hindostan (to which nothing can more contribute than this determination which your Excellency has made), and sensible that no means can add to the confidence of men of property, in the event of future emergency, more than a rigid adherence to justice in concerns of this nature, has been pleased to direct me to comply with your application for the assistance of the Company in order to ascertain the true and just debts, with a view to their being put into a train of payment.

I beg leave, therefore, to inform your Excellency that I wait for the return of Tickait Roy to Lucknow, pursuant to your Excellency's orders, to commence on the investigation of the debts. When the investigation is concluded, I shall be happy to transmit your Excellency's further commands on this subject for the sentiments of the Governor General.

(No. 32.)

FROM the Vizier to the Resident. (Received 2 November 1795.)

I HAVE desired Rajah Tickait Roy and Rajah Butchraje to repair to Lucknow. You are from your heart disposed for the prosperity and reputation of my Government. I have communicated my sentiments on the debts due to Europeans and bankers to Rajah Butchraje. You will consider the representations of Rajah Butchraje relative to the debts, and every other matter whatever, as my pleasure, because you are anxious for the prosperity of my Government. I am in every sense pleased with and thankful for your friendship, and in every respect am confident and happy. I consider my welfare and the prosperity of my affairs to depend entirely on the favour of Providence and your friendship and exertions; and I am convinced that through your means this heavy load of debt will be easily and with every accommodation paid, and I shall be grateful.

(No. 33.)

FROM the Vizier to the Resident, acknowledging the receipt of the Letter from the Resident dated 24 October. (Received 2 November 1795.)

It is a source of great satisfaction to me that the Governor General was pleased on learning my determination to discharge the debts due from my Government, and that, impressed by the sincerity of friendship, he is at all times anxious for the prosperity and welfare of my Government, and from his heart is desirous to see my dignity and respectability increase; that wishing for my happiness and ease in every matter, and particularly in affairs of this nature, he had written to you on the subject. I trust that you will be convinced that I am in every respect confident in, and satisfied with, your friendship and goodness, and that my heart is overjoyed. I have the most sincere confidence that by the blessing of God, and with the boundless kindness of the Governor General, you will devote yourself with sincerity and zeal to the prosperity of my Government. Now that Rajah Tickait Roy and Rajah Butchraje are going to Lucknow, you will, with the purest friendship and impartiality, and considering the reputation of my Government concerned, inquire into the just and fair debts which are due from my Government to Europeans. When the investigation is brought to a close, you will let me know the result; for on a view of the confusion which, by the system of contracting debts, had crept into my disbursements, and occasioned the most inexpressible distress to my Government, I took the charge of my treasury myself, that a stop might be put to this evil, and have resolved to pay attention to everything. It is very well known to you that, in consequence of the distresses and incumbrances which overwhelmed me, no arrangement that is practicable and gradual could be suggested for the payment of the debts but by the kindness of Heaven, the friendship of the Governor General, and your exertions. Your friendship has made me rejoiced to the last degree, and has impressed me with the fullest confidence and ease of mind. This renovation of my Government, and prosperity which begins to appear in it, and which will daily increase, is owing solely to your friendship and to your prudence, and I am grateful to you for it. Further particulars will be known to you from the communications of Rajah Butchraje.

ACCOUNT of the DEBTS due by GOVERNMENT to the end of Zelheijeh 1209, corresponding with 18th July 1795; delivered to the Resident by Rajah Tickait Roy on 3d November 1795.

SUMS appropriated to the Expenses of Government, and to the Payment of the Company's Subsidy, negotiated by Dhunput Roy.

<i>From English Gentlemen.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Colonel Martin, exclusive of arrears due on account of the department under his superintendence - - -	- -	- -	25,00,000	
Mr. James Orr - - - -	- -	- -	7,75,000	
Mr. Geo. Johnstone - - -	- -	7,57,000		
Paid in part - - - -	- -	27,029		
			7,29,971	
Through the channel of Sherf Ally Khan.	4,75,000			
Deduct:				
From the Chowdry and other Bankers	90,000			
		3,85,000		
Not received - - - -	- -	1,50,000		
			2,35,000	
Captain Brown - - - -	- -	- -	22,017	
Mr. Robert Beecher - - -	- -	- -	1,00,000	
Dr. R. Bruce - - - -	- -	- -	4,00,000	
				47,61,988
<i>From Bankers.</i>				
Ongur Sun, &c. - - - -	- -	6,92,000		
Munsaram, &c. - - - -	- -	4,02,132		
By the hands of Kishory Doss, on a deposit of the jewels of Hyder Beg Khan.	1,43,000			
Deduct:				
Belonging to Jopaul Shah - -	7,000			
	1,36,000			
Money - - - -	1,00,500			
		2,36,000		
Munnohur Doss, &c. - - -	- -	3,12,000		
Subul Ram Gudary Loll - -	- -	1,50,000		
Matradoss Gunneah Doss - -	- -	1,01,000		
Through Bisheshun Doss - -	- -	1,36,000		
Shaw Kinchund, on a deposit of the jewels of Hyder Beg Khan.	7,000			
On a bond for three lacs - -	25,000			
		32,000		
Oody Ram - - - -	2,50,000			
Paid - - - -	1,93,000			
		57,000		
			21,18,632	
Through Bakun Doss, &c. - -	- -	3,78,000		
Busty Ram, through Lolla Sumboonat.	- -	5,90,000		
Rajah Moonim, for the use of the Kharkana.	- -	45,000		
Through Baboo Ram Sunder - -	- -	33,000		
Through Almass Ally Khan - -	- -	6,00,000		
			16,46,000	
				37,64,632
TOTAL the Expenses of Government and the Company's Subsidy, subject to the investigation of the Jumma Khurch Accounts for any difference (carried forward) -				Rs. 85,26,620

Brought forward - - -				Rs. 85,26,620
SUMS appropriated for the use of the Dowab, under the Superintendence of Rajah Hoolass Roy, exclusive of Arrears due to the Moodies.				
<i>From English Gentlemen.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	
Dr. R. Bruce - - - -	- -	50,000		
Mr. Deverinne - - - -	- -	50,000		
Through Mr. G. Johnstone and Kisshoorydoss.	- -	1,29,524		
Mr. Pringle - - - -	- -	92,269		
Colonel Martin - - - -	- -	1,05,000		
			4,26,793*	
* Of this a tunkah was granted on the Nawab of Furruckabad for 25,000, whatever may have been received of it.				
<i>From Bankers.</i>				
Doorka Doss Mootee Chund - -	- -	2,23,128		
Lolljee Likraje - - - -	- -	18,539		
Bowanny Persaud - - - -	- -	1,30,000		
Chowdry Ongur Sun - - - -	- -	1,38,043		
Beny Ram Mool Chund - - - -	- -	16,000		
Tug Chund, Shroff - - - -	- -	14,702		
Jollanaut Kishen Doss - - - -	- -	4,600		
Lolljee, Shroff - - - -	- -	10,000		
Bagonaut Persaud - - - -	- -	5,000		
Colka Doss - - - -	- -	4,200		
Nund Kishore - - - -	- -	60,000		
Bab Macund - - - -	- -	50,386		
Hur Sahai - - - -	- -	20,000		
Buny Ram, through Suckund Loll -	- -	35,000		
Berje Bookun Doss - - - -	- -	7,686		
Metoo Lall Sejeram - - - -	- -	1,060		
Besheshur Doss - - - -	- -	1,06,000		
Ahassy Ram - - - -	- -	10,622		
			8,54,966	
Beny Ram Takoor Doss - - - -	- -	29,047		
Ramisser Doss - - - -	- -	2,122		
Nobut Roy - - - -	- -	20,000		
Bugwan Doss - - - -	- -	17,206		
Dhunput Roy - - - -	- -	3,38,043		
Praun Sook, &c. - - - -	- -	25,323		
			4,31,741	
				17,13,500
			Rs.	1,02,40,120

(A true translation.)

(signed) G. F. Cherry,
Resident.

POLITICAL DEPARTMENT.

(No. 22.)

LETTER from the Court of Directors to the Government of India, dated 17 June 1857.

1. WE transmit to you herewith copies of letters and memorials from persons* residing in this country, relative to certain alleged claims upon the late Native Government of Oude, together with our answers to the same. We forward at the same time a printed copy of a return made to an Order of the House of Commons on the 17th of March 1857.

* Children of the late Lieutenant Colonel Edwards.
Rev. James Fendell, executor of the widow of Mr. Robert Grant.
Representative of the late Colonel Frith.
Mr. J. H. Clark.

2. With reference to these documents, and to any others, of a similar character, which may have been submitted directly to your Government by claimants in India, we desire that you will, with as little delay as possible, cause all *bonâ fide* claims against the late Native Government of Oude to be investigated and reported upon, either by the Financial Commissioner of Oude, or by some officer specially appointed for the purpose (acting under the orders of the Chief Commissioner), with such establishment as you may think fit to authorise.

3. We desire that you will give us the earliest possible information of the arrangement which you make in pursuance of these instructions.

We are, &c.
(signed) R. D. Mangles,
F. Currie,
&c. &c. &c.

EAST INDIA (CAPTAIN FRITH).

P A P E R S

RELATING TO THE

CLAIM OF CAPTAIN FRITH

ON THE

LATE STATE OF OUDE.

(*Mr. Wylia.*)

*Ordered, by The House of Commons, to be Printed,
27 July 1863.*

519.

Under 2 os.

EAST INDIA (CAPTAIN FRITH).

RETURN to an Address of the Honourable The House of Commons,
dated 26 June 1860;—*for*,

A “COPY of all CORRESPONDENCE, MINUTES, and REPORTS relating to
the CLAIM of Captain *Frith* on the late Government of *Oude* (in
continuation of Return presented on the 30th day of July 1858).”

India Office, }
24 July 1860. }

J. W. KAYE,
Secretary in the Political Department.

(*Mr. Ayrton.*)

Ordered, by The House of Commons, to be Printed,
25 August 1860.

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COPY of all CORRESPONDENCE, MINUTES, and REPORTS relating to the CLAIM of Captain *Frith* on the late Government of *Oude* (in continuation of Return presented on the 30th day of July 1858).

From *J. C. Melvill*, Esq., to *W. H. L. Frith*, Esq., dated India Office,
22 July 1859.

Sir,

I AM directed by Sir Charles Wood to inform you, in reply to your letter of the 11th of July, requesting to be furnished with a copy of the report of the Government of India on the claims which you have advanced against the late Native Government of Oude, that it is not the practice of Her Majesty's Government to supply copies of public Despatches to private individuals, but that on applying to the Secretary in the Political Department of this office you will be permitted to read the report to which you refer.

I am, &c.
(signed) *J. Cosmo Melvill.*

From *J. C. Melvill*, Esq., to *W. H. L. Frith*, Esq., dated India Office,
29 July 1859.

Sir,

I AM directed by Sir Charles Wood to acknowledge the receipt of your letter of the 27th ultimo, inquiring whether any report has been received from the Government of India respecting the claims advanced by your family against the late Native Government of Oude, and I am instructed to inform you in reply, that the Government of India, in a Despatch dated 17th May 1859, and received since the receipt of your letter, have reported circumstantially on your case, and recorded an opinion adverse to your claim, recommending that it "be rejected." Her Majesty's Government see no reason to doubt the propriety of this decision.

I am, &c.
(signed) *J. Cosmo Melvill.*

From *W. H. L. Frith*, Esq., to Sir *Charles Wood*, dated Bacon's Hotel,
Albion-place, Hyde Park Square, 8 December 1859.

Sir,

REFERRING to your letters to me of the 22d and 29th of July last, I beg to say that, in accordance with the permission contained in that of the 29th of July, I took the opportunity of inspecting, in the hands of the Secretary of the Political Department, the Despatch received from the Government of India, on the subject of my claim.

That Despatch has since been printed, in pursuance of an order of the House of Commons.

In that Despatch, paragraph 37, a reference is made to a memorial presented by my grandfather, Colonel Robert Frith, on the 1st of October 1790, and an extract given from that memorial.

I have not a copy of this memorial; and as an extract from it is thus used against me, I trust that I will be permitted to obtain a copy of it, as well as all documents, if any, which were annexed to it, from the India House.

I will feel very much obliged if directions are given that I may obtain the copies as soon as they can be conveniently given.

I have, &c.
(signed) *Warren Hastings L. Frith.*

From *J. Cosmo Melvill*, Esq., to *W. H. L. Frith*, Esq., dated India Office,
14 December 1859.

Sir,

IN reply to your letter of the 8th instant, I am directed by Sir Charles Wood to inform you, that on application to the Political Department of this office, you will be permitted to examine the record to which you refer, and to make such extracts from them as you may require.

I am, &c.
(signed) *J. Cosmo Melvill.*

From *W. H. L. Frith*, Esq., to Lord *Stanley*, dated 29, Spring Gardens,
28 January 1860.

My Lord,

I HAVE the honour to enclose to your Lordship for presentation to the Queen, a petition to Her Majesty setting out the claims upon the Government of India, of myself, and my brothers and sisters, as representatives of the late Colonel Robert Frith of the Bengal Cavalry.

The claim of the representative of Colonel Frith, was brought before the late Court of Directors, by a letter from me, dated the 5th day of June 1856, immediately upon the annexation of Oude.

Having been desired to make my application to the Government of India, on the 25th of July 1856 I addressed a letter to Mr. Edmonstone, the Secretary to the Government of India, bringing the claim under the notice of the Governor General.

I beg to refer your Lordship to these letters, and also to my letters to Sir James Melvill, dated respectively the 16th of April 1857, the 23d of August 1857, the 6th of January 1858, and Sir James Melvill's letters to me of the 7th of May 1857, the 9th of September 1857, and the 18th of January 1858.

I have enclosed copies of these letters, from which your Lordship will perceive that the case has been before the Governor General for inquiry, and that an early report has been promised.

In the meantime, we have been advised that the proper course under the new constitution of the Government of India is to state the case in a petition to Her Majesty, that upon Her Majesty's command to that effect being graciously given, the whole case may be dealt with in whatever manner may seem right.

Trusting that your Lordship will consider this the proper course, I beg to forward the enclosed petition.

It would be impossible to encumber the petition to Her Majesty by a statement of all the documents and proofs that sustain the claim; but upon receiving your Lordship's permission, I will forward to your Lordship, for the consideration of yourself and the Council for India, a full statement of the documents and evidence which sustain the case made in the petition.

Trusting that your Lordship will be of opinion that the claim so preferred is founded in justice,

I have, &c.
(signed) *Warren Hastings Leslie Frith.*

Sir,

Oriental Club, 16 April 1857.

IN June last I submitted to the Honourable Court the claim of my late father, Colonel Frith, of the Bengal Artillery, on the late Government of Oude, and was, in reply, informed that I should apply to the Government of India on the subject. I did accordingly on the 25th of July last apply to the Government of India, but have not received from it any reply.

I trust I shall not now be considered importunate in requesting to be informed what answer the Honourable Court purpose to give to my claim.

I remain, &c.
(signed) *W. H. L. Frith.*

Sir J. C. Melvill, K. C. B.

Sir,

Oriental Club, 23 August 1857.

WITH reference to your letter of the 7th of May last, in which you inform me that the Court will "immediately" write to the Government of India on the subject of my claim against the late State of Oude, I hope I shall be excused for troubling you with a request to be informed what course the Government of India have been instructed by the Honourable Court to adopt for the purpose of inquiry into these claims, in order that I may have an opportunity of submitting to it the proofs in support of my claim.

Your obedient servant,
(signed) *W. H. L. Frith.*

Sir J. C. Melvill, K. C. B.

Sir,

Oriental Club, 6 January 1858.

WITH reference to your letter to me of the 9th of September last, in which you inform me that the Court of Directors do not expect any early reply on "the subject," may I be excused for asking to be informed whether the Court has now received any reply from the Government of India on the subject, and if so, whether the Court would have any objection to send me a copy of such reply.

I am, &c.
(signed) *W. H. L. Frith.*

Sir J. C. Melvill, K. C. B.

The following are Replies to the foregoing Letters.

Sir,

East India House, 7 May 1857.

I AM commanded by the Court of Directors of the East India Company to acknowledge the receipt of your letter of the 16th ultimo, requesting to be informed what answer the Court propose to give to your claim against the late Government of Oude, and, in reply, I am directed to state that the Court have not yet received from the Government of India a report upon the letter which you addressed to that Government in July last, but they will write immediately to call for the opinion of the Government on your claim, as well as on the other claims, which have been made of a character similar to that advanced by you.

I am, &c.
(signed) *James C. Melvill.*

W. H. L. Frith, Esq.

Sir,

East India House, 9 September 1857.

I AM commanded by the Court of Directors of the East India Company to state, in reply to your letter of the 23d ultimo, that the Court have instructed the Government of India to adopt measures for the investigation of your and other pecuniary claims against the late Government of Oude, but under existing circumstances they do not expect any early report upon the subject.

W. H. L. Frith, Esq.

I am, &c.
(signed) *James C. Melvill.*

Sir,

East India House, 18 January 1858.

I HAVE laid before the Court of Directors of the East India Company, your letter of the 6th instant, "asking to be informed whether the Court has now received any reply from the Government of India," to their Despatch (requesting the Governor General in Council to inquire, at the earliest convenient period, into the claims put forth by yourself, and others against the late Native Government of Oude), and whether, if such answer has been received, the Court would have any objection to send you a copy of it.

I am directed to state in reply, that the Court have received a Despatch from the Governor General in Council, dated the 22d August 1857, intimating that the Court's instructions will be carried into effect as soon as the affairs in Oude will permit the institution of such an inquiry.

W. H. L. Frith, Esq.

I am, &c.
(signed) *James C. Melvill.*

To Her Most Gracious Majesty the Queen.

THE Humble Petition of the undersigned, Her Majesty's most dutiful and loyal subject, Warren Hastings Leslie Frith, Oriental Club, London, executor of Warren Hastings Leslie Frith, Colonel Bengal Artillery, deceased, and who is now the sole legal representative of Colonel Robert Frith,

May it please Your Majesty,

Most humbly sheweth,

That your petitioner humbly approaches Your Majesty as now the direct and supreme ruler of the Indian Empire to prefer to Your Majesty a claim for payment of a debt justly payable to him out of revenues which have now become the property of Your Majesty's Royal Crown.

That at the time of the recent annexation of the kingdom of Oude to the territories of the East India Company, your petitioner had a claim upon the Government of Oude, which that Government were bound in justice to discharge.

That by the annexation of that kingdom to the territories of the East India Company, the debts and liabilities of the late Government of Oude were transferred with the revenues, and ought now to be paid out of the revenues of that kingdom.

That in addition to this, the debt due to your petitioner was contracted under circumstances which entitled your petitioner to consider that it was contracted under the guarantee of the Government of India, and that it was one which the Government of India were bound in justice to see discharged; but that the late Court of Directors refused to recognise this liability, considering that the debt was due by the King of Oude, with whom, on the ground that he was an independent sovereign, they refused in any manner to interfere.

Your petitioner begs leave humbly to submit to Your Majesty the following statement of his claims upon the Government and revenues of Oude, and upon the revenues of India.

In the year 1784 your petitioner's grandfather, Colonel Robert Frith, was an officer in the army of the East India Company, and was then aide de camp to the Governor General, Warren Hastings.

In

In the year 1781 a treaty was concluded between the East India Company and his Highness Asoph-oo-Dowlah, the then Vizier of Oude, by which it was, among other things, agreed that the Company should give up possession of a fortress in the Vizier's dominions, called Futtu-Ghur, which they then held, and that the troops of the Vizier should in future be commanded by an officer of the Company's service, to be nominated by the Company.

That, previous to this treaty, the Government and revenues of Oude, although nominally managed in the name of the Vizier, had been entirely under the control of the Resident and officer of the Company, a fact perfectly notorious to all persons in the Indian service.

That it being a matter of the utmost importance that the post of commander of the Vizier's troops should be filled by an officer of fidelity and ability, Colonel Robert Frith was selected by the Governor General for that post, and accordingly, by the appointment of the Governor General, became commander of the troops of the Vizier of Oude.

That in accepting such post, it was never believed or considered that Colonel Frith was transferring his services from the East India Company to a foreign and independent State, but was, on the contrary, most effectually discharging his duty as an officer of the Company's army.

That under such belief, and still continuing under the protection of his own country, Colonel Frith, at the instance of the Governor General, took the command of the Vizier's troops, consisting of five battalions of sepoys with eight field-pieces, under an agreement with the Vizier that he was to receive from the Vizier, in lieu of pay, table money and all other emoluments, 5,000 Lucknow rupees per month, his pay from the Company being in the meantime suspended.

All these arrangements were entered into with the knowledge and sanction of the Governor General and the British authorities in India.

Soon after Colonel Frith so took the command, part of the troops were ordered to march to the fortress of Futtu-Ghur, to relieve the troops of the Company, who were to evacuate it under the treaty, and the remainder of the Vizier's troops were detached into the Mofussil to assist in realizing the revenue; but when the troops were about to move, the money necessary for pay and subsistence was not supplied, and the Vizier's Minister (Hyder Beg Khan) declared that he was unable to furnish the money, as all the resources of the country were required to make up a crore and five lacs of rupees, the arrears of a subsidy due to the Company, and which the Governor General had peremptorily required to be paid in the course of that year, as he had pledged himself to the Court of Directors that the money should be provided.

Hyder Beg Khan urged Colonel Frith to raise money for the troops on his own credit and responsibility, which should be repaid as soon as the pressing demands on the revenue were discharged. Colonel Frith seeing that if the money was not procured, the troops would be disbanded, and that consequences most injurious to the interests of the Company and to the British cause in India would unavoidably ensue, determined to exert himself to raise the necessary money, in which he ultimately succeeded, and with the approbation of Major Palmer, the Company's Resident at Lucknow, he advanced 40,000 Lucknow rupees for the pay and subsistence of the troops.

In so raising this money for the exigencies of the Vizier's service, Colonel Frith acted not for any private benefit or advantage of his own, but to promote the interests of the public service. Had the troops of the Vizier been then disbanded, it would have been impossible to have collected the revenue so as to pay to the Governor General the large subsidy which he demanded. From the state of turbulence which prevailed in many portions of Oude, the disbanding of the troops would have been followed by consequences most mischievous to the authority of the Vizier and of the Company in India.

In the advance, therefore, of this money to the Vizier's Government, Colonel Frith was faithfully discharging his duty to the Company. By doing so, he rendered the most essential service to their interests, and actually secured to them in direct and immediate payment of revenue, a sum far exceeding that which he advanced.

In February 1785 the Governor General (Warren Hastings) left India for England, immediately upon which Sir John M'Pherson, the Acting Governor General, ordered the Brigade of Company's troops, to again occupy Futtu-Ghur and

and the Vizier's troops under Colonel Frith were recalled and ordered to be disbanded; but the Vizier's Minister was unable to furnish the money for the pay due to the corps, and at his request Colonel Frith again borrowed on his own credit a further sum of money, which was paid to the troops, and they were disbanded.

In consequence of the events which then occurred, Major Palmer, the Resident of the East India Company at Lucknow, resigned his office in July or August in the same year; but previous to his leaving Lucknow, Colonel Frith attended before him, and made up his accounts with the Vizier of Oude, by which it appeared that there was due to Colonel Frith for his advances for the troops and for his own pay and allowances, a sum of two lacs and 70,000 Lucknow rupees, up to, and for the year 1785, and there being then no means or other mode of payment, a bond for securing to Colonel Frith and his heirs said two lacs and 70,000 Lucknow rupees, with interest at 12 per cent. per annum until paid, was duly prepared under the seals of the Vizier and his Minister, and was delivered to Colonel Frith officially by Major Palmer, the Resident.

Colonel Frith continued at Lucknow in the Vizier's service until August 1786, when he was recalled by the Company, and ordered to rejoin his regiment. At this time another year's allowance, at the rate agreed on, namely, 5,000 rupees per mensem, became due, which the Vizier was unable to pay.

The pecuniary difficulties of the Vizier prevented any part of this sum, or of the sum secured by the bond, to be paid until the year 1789 when Colonel Frith received from the Vizier or his Minister certain tunkhas or assignments on the Nabob of Furrackabad for one lac of rupees in part payment, and which were paid in three instalments in 1789, 1790, and 1791.

With the exception of these sums, nothing has, ever since the execution of the bond, been paid to Colonel Frith or his heirs, notwithstanding repeated applications to the late East India Company, and through their Resident to the successive Governments of Oude.

During the life of Asoph-oo-Dowlah the importance and justice of making provision for the payment of all his debts were fully recognised by the Governor General of India; but, owing to the embarrassed state of the Oude finances, the large subsidies drawn from the revenue by the East India Company, and the unsettled relations between the British Government and the State of Oude, no such arrangement was made.

Asoph-oo-Dowlah died in 1797, and in the following year his brother, Saadut-Ali-Khan, was raised by the British Government to the musnud or sovereignty, to the exclusion of a person claiming as son of the late Vizier, but whose claims were set aside on the ground that he was considered unfriendly to the British Government.

Upon the accession of Saadut-Ali-Khan, a treaty was entered into between him and the East India Company, which contained the following stipulations: "That the just debts of the Vizier Asoph-oo-Dowlah shall be discharged by the Nabob Saadut-Ali Khan, and an arrangement for that purpose shall take place within 12 months after the elevation of the said Nabob Saadut-Ali-Khan to the musnud.

"That the whole shall be liquidated in three years after that date."

On the 31st January 1798, Colonel Frith furnished to the new Vizier Saadut-Ali-Khan, an account of the amount then due to him, but the financial condition of the revenue of Oude did not admit of this being paid.

It subsequently appeared that in the year 1801 the East India Company agreed to rescind the previous treaty, and a new treaty was entered into between the Company and the Vizier in terms very similar to the previous treaty, but omitting any stipulation, binding the Vizier to pay the debts of Asoph-oo-Dowlah, and such omission was used to defeat the claims of the creditors of the Vizier upon the Government of Oude.

In the year 1800 Colonel Frith died in distressed circumstances, in consequence of the debts he had incurred in making the advances he had made, and not obtaining the repayment of the sums so due to him by the Government of Oude; having only one child, an infant (your petitioner's father), the late Warren Hastings Leslie Frith, upon whom all right and interest in the bond so passed to his father devolved.

Upon the death of Colonel Robert Frith, his brother, Colonel Richard Frith, proved his will and became his executor, and was possessed of the original

original bond passed by the Vizier of Oude, and other papers and accounts and vouchers.

In 1804, Colonel Richard Frith was stationed with his regiment at Futtighur. At this time Holkar was at war with the East India Company, and on the 17th November in that year he attacked Futtighur and burned the cantonments of the Company's troops there, amongst others, the bungalow of Colonel Richard Frith was destroyed, and in it the original bond and papers.

In June 1806, Colonel Richard Frith furnished an account to the Vizier, with the following statement :—

“That the total due by the Lucknow Government to the estate of the late Lieutenant Colonel Frith, exclusive of the interest on the allowance for 1785–86 amounts to two lacs 28,000 Lucknow sicca rupees on the 31st July 1805.

“The bond above-mentioned with the several papers relative to this demand were burned in my bungalow at Futtighur on the 17th November 1804, by Juswant Row Holkar's troops. But I declare most solemnly to the best of my recollection, knowledge and belief, that the account as here stated is correct, and that the sum of two lacs and 28,000 Lucknow sicca rupees, was actually due to the estate of the late Lieutenant Colonel Frith by the Lucknow Government in August last. And this I am ready to make oath before a magistrate should his Excellency the Nawaub Vizier require it. Gazeepore.”

Independently of this Your Majesty's petitioner is prepared with the clearest proof of the passing of the bond, and the justice of the claims for which it was passed.

In 1804 your petitioner's father (Warren Hastings Leslie Frith) went out to India as a cadet, and from that period up to his death which happened in January 1854, he made repeated applications both to the East India Company and to the successive sovereigns of Oude, for payment of the debt so justly due to his father.

In the course of these applications it was urged that the debt was contracted under circumstances which should induce the East India Company to interfere in order to obtain payment, but the Court of Directors declined all interference in the matter, and the then state of the law gave Colonel Frith no means or power of obtaining any redress by legal proceedings.

The successive Viziers of Oude refused to pay the debt so incurred by the Vizier Asoph-oo-Dowlah upon the ground solely that they did not consider it incumbent upon them to have any concerns with demands referable to the time of Asoph-oo-Dowlah, and because the adjustment of them was not mentioned in the existing treaties with the Company.

Your Majesty's petitioner most respectfully submits that there is no pretence in law or justice for such repudiation on the part of a succeeding sovereign a debt like that due to Colonel Frith or debts contracted for State purposes, and under the authority and upon the credit of the State; that there were no grounds for stating that it was not a just demand against the Government of Oude; and that it constituted a claim upon the revenues of Oude, and ought now to be discharged out of them. Your Majesty's petitioner at the same time humbly submits that the present Government of India now happily established in Your Majesty's name, represents for the purpose of this debt due to Colonel Frith, both the Government of Oude and the late East India Company, and whatever claim either in law or in justice, Colonel Frith has upon either of these bodies separately or upon both of them jointly, his representatives now have upon Your Majesty's Council for India, and Your Majesty's petitioner most humbly submits that the claim of your petitioner is thus made clear and indisputable.

Whatever the East India Company might have urged against their liability to this claim while the revenues of Oude were administered by a Government said to be independent, it becomes impossible for them justly to repudiate their liability when they assume the Government and appropriate the revenues of Oude.

Upon a review of all the circumstances, and considering the mode in which the debt was contracted in the service of the British Government in India, it will appear that every obligation of justice compels the British Government to discharge that debt, so soon as they become masters of the funds out of which it was originally payable.

In January 1854 Colonel Warren Hastings Leslie Frith died, leaving six children sole legatees of his property, namely, your petitioner, Warren Hastings

Leslie Frith, the sole executor of his will; Ellen Frith, now the wife of Sir A. Wilson, baronet, Bengal Artillery; Sally Jane, now the wife of Colonel Swinley, Bengal Artillery; Eliza Catherine, now the wife of John Adair Cragie; Robert William George Frith, deceased, and Captain John Sabatier Frith, Bengal Artillery.

The late Colonel Warren Hastings Leslie Frith at various times applied to the Court of Directors and the Government of India, to use their influence with the Government of Oude to procure payment of his claim. These applications were refused, as appears by the correspondence, on the grounds that the Government would not press any claims upon an independent sovereign.

Your petitioner therefore most humbly submits that he is entitled, as such executor, and ought to be paid the sum due on the said bond, and the sum due subsequent to the date of said bond, by the Vizier, Asoph-oo-Dowlah, out of the revenues of Oude, late the dominion of the said Vizier, and his successor. Your Majesty's petitioner most humbly submits that the lapse of time, so far from being any reason against the satisfaction of his claim, constitutes an additional hardship in his case. The family of his grandfather has been for many years deprived of income to which they were justly entitled; and the best portion of his father's life was wasted in fruitless efforts to obtain justice.

The relations between the Government of Oude and the East India Company were such that the delay in obtaining satisfaction has been justly attributable, not to the persons representing Colonel Frith, who had no means of enforcing the same, but to the course pursued by the East India Company.

In the month of June 1856, Your Majesty's petitioner addressed a letter on the subject of this claim to the East India Company, in reply to which he was on the 10th day of July 1856 desired to address his application to the Government of India.

On the 25th of July in that year, he addressed a letter to the Secretary of the Government of India to which he has never received any direct reply, that he was informed by the late Court of Directors that no report had yet been received from the Government of India, but that the Government of India had been instructed to make inquiry into this and other claims against the late Government of Oude.

Your Majesty's petitioner is advised, that since the passing of the Act of Your Majesty's Parliament, which has vested the Government of India in Your most gracious Majesty, his proper course is to present this, his humble and dutiful petition to your Majesty, in order that his claim may be brought before Your Majesty's Council for India for their decision. Your Majesty's petitioner is perfectly prepared to establish by incontestible evidence, all the facts stated in this, his humble petition, and to show that his claim is one which ought to be satisfied.

Your petitioner therefore most humbly prays, that Your Majesty may be pleased to refer this his petition to Your Majesty's Council for India, in order that the just claim of your petitioner may be satisfied, or such investigation may be made as will secure that justice may be done, or that if necessary Your Majesty may be pleased through Your Majesty's Secretary of State for India to refer the same to the Judicial Committee of Your Majesty's most Honourable Privy Council, or that such other steps may be taken to insure to your petitioner justice, as to Your Majesty's most gracious wisdom may seem meet.

And your petitioner as in duty bound will ever pray.

(signed) *Warren Hastings Leslie Frith.*

28 January 1860.

From *J. Cosmo Melvill, Esq.*, to *W. H. L. Frith, Esq.*, dated India Office,
10 February 1859.

Sir,

I AM directed by Lord Stanley to acknowledge the receipt of your letter of the 28th ultimo, with enclosed petition to Her Majesty, respecting the alleged claims of your family upon the late native Government of Oude, and I am instructed

structed to state in reply that the Government of India having been directed* "with as little delay as possible to cause all *bonâ fide* claims against the late native Government of Oude to be investigated and reported upon," his Lordship can see no reason for recommending to Her Majesty the adoption of any other course.

* Despatch in Political Department, No. 22, of 1857, dated 17 June 1857.

I have, &c.
(signed) *J. Cosmo Melvill.*

From *W. H. L. Frith, Esq.*, to *Sir Charles Wood*, dated 17 January 1860.

Sir,

I HAVE the honour respectfully to request your attention to a claim which I have preferred as executor of the late Colonel Frith, to be paid out of the revenues of India or of the kingdom of Oude, the amount due upon a bond passed to my grandfather Robert Frith, then a Captain, and subsequently Lieutenant Colonel in the Bengal Cavalry, in the year 1785, by Azoph-ul-Dowlah the then Sovereign of Oude.

I will not trouble you by a detail of the repeated applications made both by my father, my uncle, and myself to the late Court of Directors of the East India Company, with a view of inducing them to interfere to obtain payment of this demand from the Sovereign of Oude. When the territories of Oude were annexed to the British Empire an entirely new phase of the question arose. I had then to apply to the Company as themselves Sovereigns of Oude to do the justice which in former applications they had been asked to urge upon others.

I accordingly on the 5th of June 1856 presented a memorial to the Government of India, very shortly urging my claim to be paid out of the revenues of Oude.

When the Act of 1858 transferred these territories to the direct Government of Her Majesty, I was advised that a petition to the Queen then became the proper mode of proceeding.

On the 29th of January 1859, I transmitted to Lord Stanley a petition to Her Majesty, more fully stating the facts on which this claim rested, and praying that Her Majesty would take measures to deal with it as justice might require.

In reply I was informed by Lord Stanley that instructions had been already sent to the Government of India to report upon the claims against the Government of Oude, whether made by Europeans or natives.

I have since to acknowledge your letters of 22d, and 24th July upon the subject of the report in which the Government of India have recommended the rejection of my claim. In the first of these letters in reply to my request for a copy of that report, I was informed that it was not the practice of Her Majesty's Government to supply copies of public despatches to private individuals, but that on applying to the Secretary of the Political Department, I would be permitted to read it.

Since the receipt of these letters the Despatch of the Government of India reporting upon my claims, and others, has been printed by order of the House of Commons.

Believing as I do that many of the reasons assigned in this Despatch can be answered even from its own admissions, that all of them admit of a reply from facts which it is in my power to establish by proof. I must request your permission to submit to you those observations which appear to me to show objections made to my claim are unfounded.

Before proceeding to do so, I have, in the first instance, to press upon your attention my right to have my claims submitted to the decision of a judicial tribunal, in accordance not only with the invariable usage in such cases, but also with the public and distinct pledge given to Parliament upon the subject.

In the observations which I will offer upon the Despatch of the Indian Government, the necessity of such an investigation will be apparent. It is no disparagement to the eminent men who have signed that Despatch to say that it is impossible to attach to their opinion the weight which would belong to a regularly instituted inquiry. No persons on my behalf appeared before them; there was no opportunity given to me of answering objections or supplying evidence that might clear up what was doubtful.

They did not even call for any detailed statement of the grounds upon which I rested my demand, and when in my letter dated the 24th May 1858, to the then Secretary of the East India Company, I asked permission of the Court of Directors to place before the Government of India the proofs by which I sustained my claim, that permission was not accorded to my request.

The petition to Her Majesty in which I stated the grounds of the claims which I formerly preferred, was not before the Government of India.

Under such circumstances, I am sure you will feel that the opinion expressed by the Government of India, cannot be deemed the result of an inquiry into the facts, and amounts in truth to nothing more than a statement that they had not facts before them to induce them to recommend payment of the claims.

The absolute necessity of an investigation such as I ask will appear at once from considering the position in which this case stands. I may say that this debt has been the subject of controversy between the East India Company, and those whom I represent, but that controversy never extended either to the justice or the nature of the debt. During the long period in which this claim has been repeatedly pressed upon the Government of India, I always understood that the facts were admitted. I believed it to be conceded that Lieutenant Colonel Robert Frith had, in the year 1785, advanced to Azoph-ul-Dowlah sums of money for the exigencies of the State; that he had for those sums of money, and the arrears of pay due to himself, received the bond of the Vizier; and I understood that the only question ever existing in the case was, whether the British authorities of India were called on to interfere to obtain payment of this debt. Of its existence and validity, I did not suppose any question was or could be raised.

When therefore the revenues of Oude were transferred to the British authority, I regarded myself as entitled to seek payment of the claims upon the simple ground that they were in the possession of the revenues upon which that claim was a just and valid charge.

Upon reading the Despatch of the Indian Government, I find that for the first time, doubts are thrown upon the validity of the debt; at least, so far as to state that the circumstances connected with it are unsatisfactory.

I cannot complain that when appealed to in this new capacity of principal debtor, the Government should require from me, satisfactory proof of everything on which my claim is grounded; but I must, as a matter of strict justice, insist upon permission to offer it before a tribunal which will determine after hearing me, whether I have established the claim which I bring forward.

It is evident that in common justice, such a tribunal should be one that would be impartial between the claimant and the Government of India, one that would judicially determine, after receiving my proofs, and hearing what I have to offer, and that it is only by the decision of such a tribunal that any satisfactory result can be attained.

I beg to refer you in support of my application to the principle laid down in a letter from the Chairman and Deputy Chairman of the East India Company, to the President of the Board of Control, on the subject of the Carnatic debts, dated 9th of May 1832, which is to the following effect:

“The Company having become possessed of that territory, may in equity be expected to discharge out of the revenues of such territory, the just debts of its former possessor provided the same be judicially proved, and that the creditors agree to such equitable terms of settlement as may be suited to the new and advantageous position in which the transfer of the country has placed them in point of security.”

The principle is here plainly laid down, that whenever a dispute arises as to the existence or character of a debt, the question should be submitted to the decision of a judicial tribunal.

This principle has been carried out in the legislation both in the case of the Nabob of the Carnatic and of the Rajah of Tanjore.

I therefore beg most respectfully and most earnestly to press upon you my request, that the claim I have made may be referred for investigation to some tribunal of inquiry which will examine into the whole matter, receiving the proofs and reasons which I am prepared to lay before them. Mine, you will remember, is the claim of a private individual, preferring a demand upon the revenues of the State, which I allege, in justice, ought to be discharged. The law

law appears to have provided for such a case, the reference to the Judicial Committee of the Privy Council; I would therefore strongly press that the petition which I have transmitted for presentation to the Queen should be referred to that body, to advise Her Majesty whether I have established a case which entitles me to be paid the debt for which I allege the revenues of Oude in the hands of Her Majesty are in justice and equity responsible to me.

I must call your attention to the fact that a public pledge has been given to the House of Commons that an impartial judicial tribunal would be appointed to inquire into the claims which I am now pressing.

On the 5th July 1858, Mr. Fagan, the Member for the city of Cork, proposed the insertion in the India Bill of a clause providing for a tribunal to adjudicate upon my claims.

Lord Stanley, then Secretary of State for India, said in reply :

“He was quite ready to admit that which he thought would be sufficient for present purposes, viz., that there were various claims, some of which were undoubtedly valid, against the former Government of Oude, and that the transfer of the revenues of Oude to Great Britain did carry with it a liability for such debts of the former Government as were fairly and justly contracted.

“Following in that first admission must necessarily be the one that it was expedient such claims should be investigated. A considerable number of persons had claims against the Government of Oude, and the greater number of those persons were natives of India. Obviously, then, those claims could best be investigated by a commission on the spot; such a commission it was proposed to appoint. That idea had been entertained by the Government of India and would, he expected, be carried out without any great delay; such a tribunal once appointed, to it must be referred all claims against the Government of Oude, whether made by Europeans or natives, and he did not doubt that the party whose claims the Honourable Member for Cork had advocated, would be able to have ample justice done him without the intervention of the Act of Parliament.”

This positive and distinct pledge of the Minister of India has not been performed. The reference to the Indian Government cannot be said in any sense to have fulfilled it. That reference had been made before the pledge was given, and the assurance which was given to the House of Commons by Lord Stanley was that a commission of investigation should be appointed. On the faith of that assurance the proposal to insert a clause in the India Bill, providing a tribunal to adjust these claims, was withdrawn.

As touching upon the very foundation of the claim, I ask your attention to the admission of Lord Stanley that the British Government, in taking possession of the territories and revenues of Oude, made themselves responsible for all claims which could justly be brought against the former Government. To use the words of Lord Stanley, “all debts fairly and justly contracted.”

On the 2d of May 1857, Mr. Vernon Smith, in his place in Parliament, assured the House of Commons, in reply to a question relating to this very claim, “that all public and *bonâ fide* claims would be paid out of the revenues of the country.”

Immediately on these pledges, thus solemnly and publicly given by two successive Ministers of the Crown, I ask, in the first place, for a judicial investigation into my claim, which was promised. I undertake to prove beyond all doubt, that I have a claim upon the Government of Oude for a debt “fairly and justly contracted.” I prefer a “public and *bonâ fide* claim,” and I therefore ask that it be paid out of those revenues of which Her Majesty’s Government have taken possession.

I venture to say that, trying the validity of my claim by this test, very many of the observations made upon it in the Despatch of the Government of India do not in any degree affect it, and in the reply which I beg respectfully to offer to that Despatch, I propose to direct all my observations to this the real point of my case, that I, at the time of the transfer of the Government of Oude, had “a public and *bonâ fide* claim,” “a debt fairly and justly contracted.”

The case which I submit is very plain and short. In the year 1785, my grandfather, whom I represent, advanced, under circumstances of great emer-

gency, sums for the public service of the Government of Oude : to secure the repayment of these sums he received the bond of the then sovereign of Oude ; a large sum still remains due on that bond. I thus establish every ingredient which constitutes "a public and *bonâ fide* claim ;" "a debt fairly and justly contracted" by the Government of Oude.

I will now proceed to offer replies to the reasons assigned in the Despatch for recommending that the demand should not be paid.

In the second paragraph the "inexpediency" of making any admission by an offer of payment, is urged on the ground that it would probably cause many similar claims to be "raked up" not only in the case of Oude, but also in the case of other native states which have lapsed to the British Government.

I think I may venture to observe upon this, that if my demand be a just one, no consideration of expediency ought to prevent its liquidation, and that even if the danger of setting a precedent for the "raking up" of all demands existed, it is impossible to use that danger as an argument to justify the refusal to pay a debt for which in equity and good conscience the Government are liable.

The only question really is whether such a liability exists, and I cannot but think it unfortunate that in the very front of their opinion on my case, the Indian Government should have put forward an argument founded not in justice, but on the consequences that it is supposed might follow from the discharge of this obligation.

But in truth this argument contains an entire misrepresentation of the nature of my claim. It is not now brought forward for the first time.

It has been constantly pressed since the time it arose.

The existence of the debt was never denied. My grandfather repeatedly pressed upon the East India Company to interfere on his behalf ; my father spent his whole life and fortune in endeavouring to obtain redress. I myself have never ceased to urge this claim. A claim like this cannot be said to be "raked up," or to supply a precedent for the getting up of new demands.

The question between those whom I represent and the East India Company was never as to the validity of the debt, it was only as to the party by whom it should be paid. My grandfather alleged, and I cannot help thinking with justice, that he advanced the money under circumstances which entitled him if not in strict law, certainly in justice, to be indemnified by them. The Company rightly or wrongly denied this obligation. Our next request was, that they should urge the payment of the demand upon the sovereign of Oude, this also they refused on the ground that they would not interfere in such a matter with their ally. But their case always was, that the debt was due by the sovereign of Oude, and that the circumstances imposed upon them no obligation to enforce its payment ; whether they were right or wrong in this decision is now immaterial. That which is of importance is, that the debt was constantly brought before their notice ; that so far from being a "raked up demand" it is one that has been kept alive by urgent and repeated and constant applications ; that the just and *bonâ fide* character of the demand has been admitted under the hands of their officers ; and that, lastly, they permitted the claim to be presented to the King of Oude through their own Resident at Lucknow, although they refused to employ any influence to compel or to induce its payment.

Such a claim I need scarcely say is in a wholly different position from any one which should be now brought forward for the first time, and which might fairly be answered by the lapse of years during which the party omitted to prosecute his claim.

In the year 1785 my grandfather was appointed to the command of the Oude troops occupying the fortress of Futtyghur, he was so appointed under the stipulations of a treaty which expressly provided that a British officer should command those troops, and he accepted the appointment at the desire of the Governor General.

Scarcely had he entered upon his appointment when he found his troops on the point of being disbanded for want of pay. An application to the Minister of the Vizier was answered by a statement that he had no money, "as all the resources of the treasury were exhausted in making up a remittance of a crore and a half of rupees, which the Company were urgently demanding." The Minister of the Vizier pressed Colonel Frith to obtain the requisite amount on his own responsibility. It was true that he was in one sense a servant of the King of Oude ; but he was placed at Futtyghur for the express purpose of
watching

watching over British interests; there was no other motive for stipulating for the appointment of a British officer. It was, then, an object of vital importance to the Company that those troops should not be disbanded. Colonel Frith, with the approbation of the British Resident, raised the money from his own resources, and lent it to the Government of Oude. It was applied to the payment and subsistence of the troops. A further advance was made by him, under similar circumstances. The amount due for these advances was ascertained and settled between Lieutenant Colonel Frith and the Minister of the Vizier, with the British Resident; and a bond of the then sovereign, Asoph-ul-Dowlah, for 2,70,000 Lucknow sicca rupees, was passed to Colonel Frith, and was delivered to him by Major Palmer, the Resident, at Lucknow; and the bond was to bear interest at the rate usual in the country, viz., of 12 per cent.

In 1789 a sum was paid on account; in 1790 another sum; in 1791 another sum was received; an account was subsequently made out, of the sum secured by the bond, and interest up to date, and certain arrears of pay due to Colonel Frith from the Vizier; the 1,00,000 rupees paid on account were credited, a balance struck, and a promise was then given by the Vizier's Minister, to discharge the amount as soon as the state of the finances would admit.

None of these facts appear to be denied in the Despatch of the Indian Government. Assuming them to be true, of which ample proof has been and can be now given, the only question is, whether that was a debt, public and *bonâ fide*, "justly and fairly contracted," the discharge of which forms a liability upon the present possessors of the territory and revenues of Oude.

It will not be denied that, with the territory, the East India Company assumed the liability to all the debts due by the Government of Oude. The Despatch of the Indian Government assigns no adequate reason why this debt, due to my grandfather, should not be subject to this rule. It was, beyond all question, a debt due by the Nawab Azoph-ul-Dowlah, the grantor of the bond; it was undischarged at the time of his death; upon what ground can it be contended that the liability did not attach to his successor, who was placed on the throne by the East India Company?

The facts connected with this transfer of the Government have been already so frequently placed before the authorities of the Government of India, that I forbear lengthening this letter by repeating them. When Asoph-ul-Dowlah died, in 1797, Vizier Ali, as his eldest son, was elevated to the sovereignty of Oude by the East India Company. The Company subsequently found he was of spurious birth, and he was at once deposed by them, and Saadut Ali, the brother and rightful heir of Asoph-ul-Dowlah, was raised to the musnud, and became sovereign of Oude.

In a preliminary treaty the Company made with him, Saadut Ali, on the occasion of his elevation, a clause was inserted by which he bound himself, as sovereign, to pay the debts of his predecessor, Asoph-ul-Dowlah, but in a subsequent and definitive treaty this clause was omitted, not with any intention of releasing him from that liability, but because it was considered by the East India Company, unadvisable that those debts should be made the matter of stipulation least the East India Company should thereby cast upon them any responsibility.

And you will find that the obligation of discharging these debts was pressed upon Saadut Ali by Sir John Shore, then Governor General.

In 1798, Sir John Shore appears to have given to my grandfather a public assurance, that all the *bonâ fide* debts of Asoph-ul-Dowlah would be paid.

So far was Saadut Ali from then denying his liability to the debts of his predecessor, that in 1801 while he pleaded his inability to pay them, he added "this is an affair which will be settled between the State and the creditors of the late Nawab, and regarding which the Company are in no shape responsible, the treaty being silent on the subject."

An in 1803 in a Despatch from the Secret Committee of the Court of Directors, the Governor General was instructed to press the payment of this debt on the Nabob.

An attempt which I must call a strange one is made in the late Despatch of the Indian Government to distinguish between the case of a despotic Government and that of other States; this argument if it be worth anything amounts to this, that a despotic sovereign can make no public debt, that all the revenues of the State being at his absolute disposal, all his debts are private debts, and

that therefore his successor in the sovereignty may be considered as under no liability to pay them.

This strange doctrine, is insinuated rather than broadly stated in the Despatch, it is surely unnecessary to refute. The Government of an absolute sovereign is carried on subject to the laws of all States, and when money is advanced for State purposes and on the security of the existing Government, the credit of the State and its future resources are as completely pledged as in the case of nations with a free constitution. When it is asserted by those representing the Government of the Queen, that an absolute sovereign is at liberty to repudiate all the public engagements of his predecessors, a principle of international law is first formed which certainly carries with it very startling consequences. According to this theory any Emperor of Russia, on succeeding to the throne, is at liberty to repudiate all the national debts of Russia, on the ground that it is the private debt of his predecessor.

An attempt is made in one of these paragraphs to qualify this obviously untenable argument, by the allegation that the King of Oude was not in strictness an absolute sovereign, but merely delegated by and subjected to the permanent power, and had no authority without their consent to charge the future revenues of the kingdom, so as to bind his successor. No authority is laid down for this proposition, and in the very same sentence it is said that the Viziers of Oude exercised the right of dealing with the revenues as they pleased. The doctrine here advanced strikes at the security of a large amount of property. The East India Company claimed to have the permanent lordship over all India, so that if this doctrine now for the first time put forward against me be well founded, any debt due by any native State is invalid. Such a proposition can never receive the sanction of Her Majesty's Government. It has, I venture to say, no foundation in any measure of any Indian or any European, or any international law of any country or of any period. The King of Oude was permitted to exercise all the rights of sovereignty, to manage the national finances, to lend money to the East India Company, as he did, to a large amount.

But then it is said that "if Asoph-ul-Dowlah, or any other Vizier had the power to borrow money for the purpose of Government, upon the security of the revenues of the State, so as to bind his successors, we think it clear that he had no power to exempt his immediate successors, so as to throw the whole burthen of his extravagance upon the third or fourth generations after him, charging his debts upon the revenue of 1857, or any subsequent period.

"If Asoph-ul-Dowlah had done so, we apprehend that the British Government would not now have considered themselves generally bound to discharge such debts; after six sovereigns or viziers in succession to him had, without regard to the interests or welfare of the people, been squandering the revenues of the State upon their own personal gratifications and follies, or in amassing wealth to be dissipated by others."

It is quite obvious that no such attempt was made by Asoph-ul-Dowlah, although if he had he would only have exercised an act of sovereignty which every Government exercises, that borrows money payable at a distant day. It is not very easy to see upon what principle the reasoning in this passage is founded.

It amounts to this, that there being a just debt chargeable on the revenues of the State, because the sovereign neglects immediately to provide for it, all his successors are exempt from the obligation of repaying it.

And this argument is put forward by the Government which claims in this document the position of suzerain power throughout the whole period, and which in that position repeatedly refused to exercise the least interference with any one of these sovereigns to induce them to apply the revenues at his disposal to the payment of this demand.

But this is not all, during the very same period the East India Company were constantly borrowing money from these sovereigns; so that they have, in the amount of these loans, a sum much more than sufficient to pay the debt which the sovereign left undischarged.

If then the accumulations of the princes who were the immediate successors of Azoph-ul-Dowlah be the proper fund for payment of his debts, I say that these accumulations are now in the hands of the Government and ought to be so applied. The sovereigns of Oude disposed of these accumulations by lending them

them to the East India Company. The debts so due by the Company have been treated as debts due to the State of Oude, and therefore passing under the annexation to the British Government. In any point of view if the argument of the Despatch be well founded, it is impossible to resist my claim to be paid out of these funds. If the debts of the Vizier be private debts, then his accumulations are his private property, and ought to be applied in due course of administration to their payment. If the accumulations are put forward as the proper fund for payment, then I say that the British Government have that fund in their own hands.

I must ask, with all respect, what is the meaning of telling a creditor "all the debts contracted by Azoph-ul-Dowlah, ought to have been paid if not in the lifetime of Asoph-ul-Dowlah, at least during the lifetime of Saadut Ali?" The creditor had no power to enforce their payment. The East India Company refused even to ask him, so that the argument comes to this, that because Saadut Ali thought proper to neglect his duty, the creditor is to lose his money.

On the contrary, it is as plain as any proposition of law or sense can be that when a creditor has a charge on the revenues of a State, no act and no neglect of the rulers of that State can cancel the obligation until it is paid. If Saadut Ali was liable for this debt, and even improperly neglected to provide for it, it remains a debt upon the revenues of the State in the hands of his successors. If any inconvenience results from the delay that inconvenience surely must fall upon the State responsible for the acts of the sovereign, and not upon the creditor, whose just rights cannot be affected by those acts over which he has no control.

Neither can his right be affected by any repudiation on the part of these sovereigns. None of these sovereigns denied the existence of the debt. They did say that they were not responsible for any debts contracted in the time of Asoph-ul-Dowlah. But their saying so, could not rid them of the responsibility if it really existed. Whether they were so responsible is the question to be determined, but it is to be so determined, not by the allegations of even so many sovereigns, but by the principles and rules of justice and right. The number of denials of justice cannot make that denial the less a wrong. From four successive Sovereigns of Oude, my grandfather and father have asked for payment of this debt. They have wrongfully withheld payment. Their place is now taken by the British Government, and I make the same demand. Can that Government answer, your claim is a just one, but our predecessors have unjustly withheld payment, and therefore we will do the same? What then becomes of the pledge to pay all debts "fairly and justly contracted." My right to be paid depends upon the justice of my claim, and not upon the manner in which it was dealt with by the Sovereigns of Oude, otherwise the British Government, so far from adopting and providing for the debts of the former Government, adopts only their injustice, and repudiates their debts.

In reply to all these paragraphs of the Despatch, I answer that Asoph-ul-Dowlah being the Sovereign of Oude, had a right to borrow money for the exigencies of the Government; that the money he so borrowed was a charge upon the revenues of that State, into whatever hands they came; that the refusal of his successor to pay the debts so contracted cannot in any way impeach the validity of the creditor's claim, and that it still subsists a debt chargeable upon these revenues in the hands of the British Government.

But when we come to examine what is termed the repudiation of this debt by the Sovereigns of Oude, it will appear not to deserve that name in any sense in which it could be possibly used as an argument against the justice of my claim.

The earliest transaction of which I can find any trace, is an offer of compromise which Colonel Frith refused on the 5th February 1798. That offer appears to have been made to him by Mr. Lumsden, and to have been rejected by Colonel Robert Frith. The rejection was after the death of Asoph-ul-Dowlah, and the inference from the date is, that it was made on behalf of Saadut Ali.

At this interval of time I may have some difficulty in showing distinctly on whose behalf the offer was made; but I am able to prove that it was rejected at the date I mention, on the ground that it was a case in which the compromise was "one unworthy of the Vizier to offer, or of Colonel Frith to accept."

The next statement of Saadut Ali refers generally to the debts of his predecessor. I have already quoted the remarkable expressions in his letter to the Governor General in 1801, that "as the treaty made no mention of them, they were matters entirely between the State and the creditors of the late Nawaub," thus entirely reputing the notion that the debts of Asoph-ul-Dowlah were not to be treated as State debts.

In 1806, when Colonel Robert Frith had been six years dead, his son the late Colonel Warren Hastings Leslie Frith obtained leave of absence for the purpose of personally pressing his claims at Lucknow, upon this occasion, the answer he received from Saadut Ali was, that "the Nawaub would be most happy to pay every attention to the claims, but as all the Ministers of the late Nawaub were dead, it was out of his power to ascertain the nature or justice of the claim, and which alone prevented him from complying with the prayers of the petition."

Colonel W. H. L. Frith, it will be remembered, was precluded from making any application to the Vizier, except through the Resident at Lucknow. In 1816, when he succeeded in obtaining through the Resident the presentation of his claim, the following was forwarded to him as the answer of the Vizier :—

"I cannot consider it incumbent on me to have any concern with demands referable to the time of the Nawaub Asoph-ul-Dowlah, of which I have no knowledge whatever. My father, at the time of his accession, denied all claims of gentlemen, and others relative to the time of my late uncle, and the adjustment of them was not mentioned in the treaty, therefore neither this nor any other demands of a similar nature can at all apply to me."

Upon a reference to what really took place at the accession of Saadut Ali to the recorded opinion of Lord Mornington, and to all the transactions of the period, it is perfectly plain that this which is called a repudiation of the debt, amounted to nothing more than an evasion upon the most frivolous pretences of the payment of a claim, the justice of which it was impossible to deny.

Lord Mornington, in the preliminary discussion on the subject of the treaty, declared "that the justice and necessity of discharging the *bonâ fide* debts to the native creditors of the State, and also the arrears of the civil and military establishments, were apparent."

I am very unwilling to lengthen this letter by adverting in detail to passages in the Despatch which I can scarcely think are put forward as a serious answer to my claim, but I am compelled to call your attention to some at least of the grounds upon which it is suggested that the Government of Her Majesty should follow the precedents set by that of the Nawabs in refusing payment.

When it is said that in 1799 the justice of the claim might easily have been investigated, I answer, the justice of the claim had then been investigated in the most formal and complete manner, and with the sanction of the Resident of the Company attesting its correctness.

But the Despatch goes on to assign as a reason for not discharging the demand, that if the payment had been made in 1799 the payment would have been made to Colonel Robert Frith himself, but if the payment be made now, it must be made to a descendant in the second degree from him, who would not, in all probability, have been one whit the richer if the debt had been paid to his ancestor.

I need scarcely say that by such an agreement as this the payment of any debt might be resisted after the death of the creditor. In point of fact, it is untrue. My position would be very different if my grandfather's means had not been crippled by the loss of the large sums which he advanced for the purposes of the trust, which was confided to him by the Governor General of the day. The result was that he died in comparatively embarrassed circumstances, instead of dying a rich man. He left to my father little more than this debt, for which he believed the faith both of the Oude Government and the East India Company was pledged. My father spent the best part of his life in the effort to obtain this. To his family, whom I represent and for whom I now ask justice, he bequeathed little except this claim; and I cannot but feel that, under such circumstances, it is something like a mockery to tell me that I am not to be paid, because, if the money had been paid in 1799 we might not be one whit the richer for it now. Nor do I think that any force will be given to the

the argument put forward in the same paragraph, which is founded on a statement in my grandfather's memorial, that he had borrowed the money from natives, whom he had been unable to pay unless he received the money due to himself. There is every reason, continues the Despatch, to suppose "that the persons who actually advanced the money were never repaid by him, and we would ask what security is there that they would ever receive a farthing, even if Mr. Frith is now paid the full amount of the bond and interest." I need scarcely say that such considerations never could be permitted to form a just ground of resisting the payment of a debt. It was from Colonel Robert Frith that the Government of Oude received the money; they knew no one else, and to him they are bound to repay it.

But, in point of fact, it is not to be presumed that my grandfather was permitted to leave the debts which he had contracted unpaid; he had no protection against the claim of any one to whom he had made himself liable, and all the probability is that he was compelled to pay them. In one instance I can prove that he paid a large sum to one of the parties who had advanced money to him to help him to make up the amount, but it must be felt that this is wholly immaterial; the one fact material is, that he *bonâ fide* advanced the money. I deny the right of the party to whom he lent it to refuse payment under the pretext that he may have borrowed it from others.

Although I have the legal right to the entire bond, I most cheerfully consent that as to all parties that can be shown to have any interest in it, their right shall be scrupulously guarded. The account given in by my grandfather disclosed the parties interested with himself. I ask nothing for myself or my family except that which justly belongs to ourselves.

But, in truth, the writers of the Despatch appear to feel that these considerations cannot avail against a just debt. "It may be said that if there is strict right on the part of Mr. Frith to receive payment of the bond, considerations like these cannot bear upon the question "a strict right." I allege that this is so, but I say further, that in matters of good faith, a Government ought not to stand upon these technicalities of strict right, which often defeat substantial justice; and if there be a moral obligation in equity and good conscience, binding the Government of Oude to repay the money, that then these, which I can scarcely help calling quibbles, ought not to be put forward even for the purpose of weakening the force of the obligation.

I find in this Despatch a statement as to the unsatisfactory nature of the circumstances shown to be connected with the passing of the bond.

I must say that considering the time that has elapsed, it would be difficult to say in what respect the statement made falls short of what might be expected. It is quite true that both I and my father have claimed the full amount of the bond, it is equally true that my grandfather in his original accounts disclosed the fact that as to a portion of the bond he held it in trust for Mr. Robert Grant, for Mr. Robert Bruce, and for Colonel Palmer, but surely it is not now the less my duty, it was not less the duty of my father, to press for the payment of the entire debt which is legally vested in me. I have already stated and I now repeat that I have no wish to receive into my hands a single penny beyond the share that properly belongs to my family; I will acquiesce in any arrangements which will secure the rights of other parties, but I am not the less bound to insist that the entire bond was a debt legally payable to my grandfather, and that it now is so to me.

An examination of the documents referred to in this Despatch appears to me to establish conclusively the justice of my claim. I have deferred addressing you in this letter until I had an opportunity of availing myself of your permission to inspect those documents at the India House.

The entire of the case on which the claim of my grandfather rested, is fully stated by him in a letter to Lord Cornwallis of the 19th of October 1790; that letter I take the liberty of annexing.

You will perceive that the request then made by my grandfather was that the Government of India should take steps to obtain payment of his claim from the Vizier. The reply of the Governor General does not deny the justice of the claim, but denies the right of the British Government to interfere. I cannot help observing that the expression "private debt" which is used in the minute of the Governor General by no means bears the construction which is attributed

to it in the Despatch. It obviously means that the debt was one due to Colonel Frith as a private individual and not as a public officer of the Company, but so far from implying that it was not a debt binding on the successor of the prince by whom it was contracted the minute expressly gives permission to Colonel Frith to apply for payment to that successor.

I also beg to call your attention to the letter, a copy of which I likewise annex, addressed by Captain Frith to Sir John Shore, this letter contains a full and clear statement of all the particulars of the claim, the parties who shared in it and the proportions in which they were entitled. It also furnishes, if such were necessary, a complete answer in point of fact to the argument of the Despatch, that because Captain Frith borrowed the money himself, therefore his representatives ought not to be paid.

These documents also establish that the rate of interest of 12 per cent. fixed, was that at which Captain Frith was himself compelled to borrow the money which he raised upon his own credit.

They will further prove the deep and permanent injury which the withholding of this money inflicted on Captain Frith, and on his family.

They establish, I am bold to say, the perfect *bonâ fides* of the claim, they prove that it was on a debt justly due by the Government of Oude; a public debt contracted for public purposes; a debt for monies advanced by Captain Frith to the Government of Oude, to obtain which he pledged his own credit and crippled his own resources, and which is still fairly and justly due to his representatives.

Fortified by these documents, I say with confidence that all the objections which have been made to my claim resting on any impeachment of the perfect *bonâ fides* of the original transaction, are entirely and satisfactorily disposed of.

Of the facts in which the claim originated, and of its existence and character, there is no longer any possibility of doubt.

The only additional reasons assigned for the refusal to pay my demand are —

- 1st. The amount to which it is swelled by interest.
- 2d. The expiry of time.
- 3d. The repudiation of the debt by the Sovereigns of Oude.

As to the first. My memorial has already stated that an adjustment of the claims for interest might reasonably be made. This offer is treated in the Despatch with something like contempt. I have before referred to the principles laid down by the late Court of Directors to the President of the India Board, in a Despatch dated 9th May 1832, as to the mode of dealing with the creditors of native States whose territories lapsed to the Company. "The Company having become possessed of that territory, may, in equity, be expected to discharge out of the revenues of this territory the first debts of its former possessor, provided the same be judicially proved, and that the creditors agree to such equitable terms of settlement as may be suited to the new and advantageous position in which the transfer of the country has placed them in point of security. Such was the arrangement made with the creditors of the Carnatic and of Tanjore."

Upon this principle, certain Acts of the Legislative Council of India have been passed within the last year, providing for the debts of the Nabob of the Carnatic.

With reference to the lapse of time, I beg to submit that if the debt was originally a just and valid one, nothing has occurred in this case to make it less so now. The lapse of time is very properly used against those who neglect to prosecute their rights; this is not the case here, except by the interference of the English Government; neither my grandfather nor my father had any power of compelling the successive Sovereigns of Oude to pay this debt; all that was possible for them they did. They made application to the Government of Oude; they urged upon their own Government the duty of interfering to obtain payment. It is impossible to set up against this, delay as a reason for withholding justice from those who have certainly shown no want of diligence in asserting their rights. The delay in payment has been a wrong on the part of the Government of Oude. It is a settled maxim of every jurisprudence, that no one can take advantage of his own wrong; and I cannot help thinking that it would be a very strange reply to a just claim to say, that it ought to have been paid

paid on the first application : and that because we did the wrong of not paying it then, we will do the additional wrong of refusing to pay it now.

I, therefore, submit that the lapse of time ought not to prejudice me in the claim which I prefer.

I have already adverted to the argument drawn from the repudiation of the claim by the Sovereign of Oude. I think I have shown that the real question is not whether they refused to pay this debt, but whether they have just grounds for doing so.

But I must repeat that, in the only really important sense of the word, the Sovereigns of Oude never repudiated this debt, they never denied that it was a debt "fairly and justly" due by Asoph-ul-Dowlah; they merely said they would not hold themselves responsible for his debts. If after anything like an investigation into the circumstances of the debt they had refused payment, on the ground that having investigated it they were not satisfied of its fairness, then I admit such a repudiation, although not conclusive against me, would be entitled to weight.

I need not say that nothing of this kind took place. The alleged repudiation consisted in a denial of their liability to the debts of Asoph-ul-Dowlah.

It is quite plain upon what that denial was founded; in the transactions which occurred on the death of Asoph-ul-Dowlah, and the annexation of a large portion of his territories to those of the East India Company. Subsequently a preliminary treaty was signed, by which the new Nawaub bound himself to pay them. This article was abandoned only on the ground that it would have involved the Company in the responsibility of investigating the validity of each debt. Of this state of things the new Vizier took advantage, and denied his responsibilities to his predecessor's debts, on the ground that a portion of the territory of that predecessor had been taken from him. In fact, the alleged repudiation was not a denial of the debt, but an allegation that the East India Company, and not the Sovereign of Oude, was the proper person to pay it.

I must, however, call your attention to the proposals made; first, to assume on the part of the East India Company the liability of these debts in certain events which were not realized; secondly, to bind the Nawaub to pay them. These proposals amount to a clear and distinct recognition that the debts of Asoph-ul-Dowlah were subsisting debts properly chargeable on the revenues of Oude. They furnished a conclusive answer to the argument of the Despatch, founded on the supposed incapacity of Asoph-ul-Dowlah to bind the revenues in the hands of his successor. To suppose that the arrangement, by which the East India Company took a part of the territories of Oude, exempted the successor from these debts, without transferring them to the Company, is nothing more or less than an assertion that the Company and the new Vizier entered into a juggle to cheat the creditors of the State.

I place before the Government of Her gracious Majesty my claim to be paid this debt out of the revenues of the kingdom of Oude, which now form part of Her Majesty's Indian revenue.

I assert that my grandfather, whose rights I represent, lent monies to the Government of Oude for purposes of State necessity, and that by this loan a liability attached not merely to the existing sovereign, but to every successive Government of Oude, binding them to the discharge of that debt.

I assert that the moment the East India Company took possession of the revenues of Oude, they took them liable to this debt, and were bound to discharge it out of those revenues.

When the territories and revenues passed to Her Majesty, the same liability attached to them.

The lapse of time supplies no answer to the claim, if it was originally well founded; the delay in payment is one for which neither Colonel Frith, nor any one representing him, can be held responsible, and the consequences of which cannot, without the most grievous injustice, be visited on them.

The denial of the liability by the recent sovereigns of Oude cannot destroy the liability, if it existed.

I claim the fulfilment of the pledge solemnly given by two successive Ministers for India to the British Parliament, "that all public debts, fairly incurred, should be paid."

I claim also the fulfilment of the pledge solemnly given by Lord Stanley, that a judicial tribunal should adjudicate upon my claim. I ask, first, a full and fair investigation before any tribunal that will be impartially constituted, that will hear the evidence I have to offer, the reasons I have to submit, and also hear all that can be alleged against me, and then decide whether I have established a claim in justice to be paid out of the revenues of Oude now in the possession of Her Majesty.

Should such a tribunal decide against me, however much I may lament the decision, however much I may still deplore the hardship of being deprived of the patrimony which would have come to my father, and from him to me, I will at all events feel that justice has been done, and that I have no reason to complain of the conduct of Government.

In closing this letter, I may be permitted to say, that I should deeply regret if a single expression I have used could appear disrespectful to the Governor General of India, or his colleagues in the Council who have signed the report. I have, of course, freely answered the arguments they have used, and I protest in the strongest manner against their opinion being regarded as the result of an investigation into my claim; it is the argument of those whose duty it is to protect the revenues of India, and I may safely assume that the very strongest arguments that could be urged against me are contained in the Despatch to which statesmen of such distinction have attached their names.

I still claim my right to have my claim fully and fairly investigated, and that the opinion of a judicial tribunal should be obtained upon the question of the liability which I assert to exist; I have, therefore, to express my earnest hope that when the petition I had the honour to transmit to Lord Stanley is laid before Her Majesty, I may be permitted to establish my claim before some tribunal who will, after full inquiry, determine upon its equity and justice.

In conclusion, I have to call your attention to the fact that I have not yet received any notification that the petition which I had the honour to forward to Lord Stanley had been laid before Her Majesty, to whom it was addressed; I would rather infer, from Lord Stanley's letter in reply, that, pending the reference to the Indian Government, he had deferred its presentation.

Presuming that I have taken the correct course in thus respectfully and dutifully submitting to Her Majesty a statement of my claim, I feel it right to observe that I have not received any answer to my request for its presentation to Her Majesty, and formally to repeat that request.

If in addressing the petition to Her Majesty I have fallen into an error, I shall, I need not say, be happy to follow any course that may be pointed out as the correct one for obtaining a decision upon the justice of my claim.

I have, &c.

(signed) *Warren Hastings Leslie Frith.*

To the Honourable Sir *John Shore*, Bart., Governor General in Council.

Honourable Sir,

I TAKE the liberty of submitting to your consideration a short statement of my claims against his Excellency the late Nabob Vizier, and persuade myself it will be received with an indulgence proportioned to the urgency of the necessity it compels me to intrude it on your notice.

The unexampled hardships I have suffered, and am still labouring under from the delay in the settlement of this account will, I am confident have its due weight with you; for the present permit me briefly to state that debts which I contracted to carry on his Excellency's service, while in command of a corps of five battalions at Lucknow, are still due to a very considerable amount to the houses of Butchroye, and the late Kashumry Mull, besides about 60,000 rupees in Calcutta, and that these debts are running on at an interest of 12 per cent., which my prospects in the service give me little hope of ever being able to liquidate unless I realise those claims. This accumulating burthen hangs heavy on my mind. However, when I reflect on the nature of the debts which were lately investigated and paid, and compare them with my own, the
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one an accumulation of interest upon interest, the other an honourable allowance granted to an officer in a command of high importance, and for money *bonâ fide* expended for the public service, I feel a perfect confidence that you will give my claim that degree of consideration it in equity merits, and that it will obtain its due place amongst the other demands on the Lucknow Government, and be early brought into a course of liquidation.

It may be proper here to observe, that while I commanded the battalions of his late Excellency's service, I never received one rupee either on account of the allowance he was pleased to grant me or of the money I advanced the sepoys, or for the feeding and other expenses of the bullocks belonging to the train of artillery attached to the corps under my command, and that these items alone form the principal of the demand.

It is with some hesitation, honourable sir, I venture to mention the circumstance which has principally influenced me to solicit your interference in my behalf in the present business, but it is of a nature that will I trust plead best its own excuse.

A constitution shattered and impaired by a long service in this climate, and repeated attacks of ill-health, as well as the advice of my medical friends, have strongly impressed the necessity on my mind of availing myself of the indulgence of a visit to Europe as early as possible, but involved in embarrassments as I am at present, and without the means of defraying the indispensable expenses of the voyage, I have been obliged to procrastinate, and must ultimately relinquish the design be the consequences what they may, unless I obtain an adjustment on the Lucknow Government. Thus situated, I look confidently to your justice for a favourable consideration of my claims and,

I have, &c.
(signed) *Robert Frith.*

Camp, near Lucknow, 3 February 1798.

From Sir *George Clerk* to *W. H. L. Frith, Esq.*, dated India Office,
5 March 1860.

Sir,

I AM directed by the Secretary of State for India, to acknowledge your letter of the 17th January (received on the 31st January), respecting your claims on the Government of India, as successors to the late Native Government of Oude, and, in reply, I am to state that the arguments now advanced by you have failed to alter the opinion of the Secretary of State for India, that the claim which you have advanced against the Government of Oude, of 1789, cannot be recognised by the British Government.

I am, &c.
(signed) *George Clerk.*

From *W. H. L. Frith, Esq.*, to the Under Secretary of State for India, dated
29 Spring Gardens, 7 March 1860.

Sir,

I BEG to acknowledge the receipt of the letter of the 5th instant, and have received with great regret and surprise the intimation that the Secretary of State for India has seen no reason to change his opinion, that the claim I have made is not one that ought to be recognised by the British Government.

Upon referring to my letter you will observe that I made a distinct request that in accordance with a pledge publicly given to the British Parliament by Lord Stanley, my claim might be referred either to the Privy Council, or to some judicial tribunal to determine.

I beg respectfully to ask whether I am to understand this letter as a refusal to refer the matter to any judicial determination.

I beg also to call your attention to a question put in my former letter to which I assume, from an accidental omission, I have received no reply.

On the 29th of January 1859 I transmitted to Lord Stanley a petition for presentation to Her Majesty the Queen.

I asked in my last letter to be informed whether this petition had been presented, and I now beg to repeat this question, trusting that you will inform me whether the dutiful petition which I had the honour of forwarding, has been laid before Her Gracious Majesty.

I am, &c.

(signed) *Warren Hastings Leslie Frith.*

From *T. G. Baring*, Esq., to *W. H. L. Frith*, Esq., dated India Office,
19 May 1860.

Sir,

I AM directed by Sir Charles Wood, to acknowledge the receipt of your letter of the 7th (received on the 20th) of March, and to inform you in reply that he has no knowledge of any "pledge publicly given to the British Parliament by Lord Stanley," to refer your claim against the late Native Government of Oude "either to the Privy Council, or to some judicial tribunal," and he has no intention himself to adopt any such course.

With respect to your question, as to whether the petition to the Queen, which you sent to this office in January 1859, has been laid before Her Majesty, I am directed to refer you to Mr. Melvill's letter, of the 10th of February 1859, and to state that the petition has not been presented.

I am, &c.

(signed) *T. G. Baring.*

From *W. H. Frith*, Esq., to the Under Secretary of State for India,
dated 8 June 1860.

Sir,

29, Spring Gardens, Charing Cross.

I HAVE to acknowledge the receipt of your letter of the 19th of May last, in which you acknowledge, on the part of Sir Charles Wood, the receipt of a letter of mine, dated the 7th, but, it appears, not received until the 20th of March.

As Sir Charles Wood states that he has no knowledge of any public pledge publicly given to the British Parliament by Lord Stanley that my claim should receive a judicial investigation, I beg, for his information, to refer to the debate in the House of Commons on the 5th of July 1858, when in Committee on the India Bill. Mr. Fagan, then Member for the city of Cork, proposed a clause, providing for a decision on my claim; Lord Stanley, as reported in Hansard, spoke as follows:—

"He thought it would be the opinion of the Committee that it would not be desirable for him to go into the details of the question, which the Honourable Member for Cork had brought under the notice of the Committee. The case was one of very long standing, and one, he (Lord Stanley) believed, of some hardship. It had more than once been debated in that House, but it would be impossible to do justice on either side, unless it were gone into at considerable length. He was quite ready to admit that which he thought would be sufficient for present purposes, namely, that there were various claims, some of which were undoubtedly valid, against the former Government of Oude, and that the transfer of the revenues of Oude to Great Britain did carry with it a liability for such debts of the former Government as were fairly and justly contracted."

"Following on that first admission must necessarily be the one that it was expedient such claims should be investigated, but there arose two further questions, first, in what manner and before what tribunal it was desirable to have them investigated: and next, whether it was desirable to insert anything in respect of their adjustment in the Bill then before the Committee? Now, though the settlement of such debts might be a very important subject, it was one which had no intimate connexion with the Bill for the Home Administration of India.

"The two questions were, in fact, entirely unconnected, and he could not think it would be a convenient practice to insert in a Bill which relates to one subject

subject clauses which related to another. Again, it was clear that whatever tribunal it might be advisable to establish for the settlement of a claim, such as that which the Honourable Member for Cork had spoken of, ought not to be established for the trial of that single case, but should be one before which all cases of this nature might be conveniently and satisfactorily tried.

"A considerable number of persons had claims against the Government of Oude, and the greater number of these persons were natives of India; obviously then those claims could best be investigated by a commission on the spot.

"Such a commission it was proposed to appoint; that idea had been entertained by the Government of India, and would, he expected, be carried out without any great delay.

"Such a tribunal once appointed, to it must be referred all claims against the Government of Oude, whether made by Europeans or natives, and he did not doubt that the party whose claims the Honourable Member for Cork had advocated would be able to have justice done him without the intervention of an Act of Parliament. Under these circumstances, he (Lord Stanley) could not consent to the introduction of the clause proposed by the Honourable Member."

I am therefore justified in my assertion that his Lordship did give to the British Parliament a public pledge that my claim should be considered by a judicial tribunal.

I must once more claim the fulfilment of that pledge.

With reference to that portion of my letter in which you inform me that my petition has not been presented to "Her Gracious Majesty," I feel bound to say that my petition being addressed to the Queen, being worded with that respectful loyalty which I deeply feel, I cannot admit the right of the Secretary of State merely at his own pleasure to stop that petition on its way to the Queen.

I have also to observe that my letter of the 7th of March last was put into the Post Office by myself at Charing-cross on the day on which it was written, and that some inquiry should be made as to the cause of the delay in its reaching the India House, especially as by reference to your letter to me of the 19th of May last you will find that this is the second occasion upon which a delay of exactly the same nature has occurred in the receipt of my letters.

I trust that on reading the extract I send from Lord Stanley's speech, Sir Charles Wood will feel that a public pledge was distinctly given which ought to be fulfilled.

In consequence of the apparent irregularity in the transmission of India House letters through the Post Office, I take this letter myself to the India House, when I hope for the opportunity of placing it in your hands.

I have, &c.

(signed) *Warren Hastings Leslie Frith.*

From *J. Cosmo Melvill, Esq.*, to *W. H. Frith, Esq.*; dated India Office,
22 June 1860.

Sir,

I AM directed by the Secretary of State for India to inform you that a further reference on the subject of the claims advanced against the late Native Government of Oudh has been made to the Government of India.

I am, &c.

(signed) *J. Cosmo Melvill.*

From *W. H. Frith, Esq.*, to the Under Secretary of State for India; dated
26 June 1860.

Sir,

29, Spring Gardens, Charing Cross.

I HAVE to acknowledge the receipt of your letter of the 22d instant, informing me, in reply to my letter of the 8th, that the Secretary of State for India had made a further reference on the subject of the claims against the late Native Government of Oudh to the Government of India.

As the Government of India has already made a very full report on my case, as directed in the late Court of Directors' Despatch in Political Department, No. 22 of 1857, dated 17th June 1857, I am quite at a loss to understand with what object a further reference on the subject has been made to it.

The only reason assigned in Mr. Melvill's letter to me of the 10th of February 1859, for the non-presentation then of my petition to Her Majesty was, that as the Government of India had not sent its report upon my case home, Lord Stanley did not see "any reason for recommending to Her Majesty the adoption of any other course."

Her Majesty's present Secretary of State for India does not, in the letter now under acknowledgment, give me any reply at all to the request that my petition to Her gracious Majesty should be presented.

I beg, therefore, now to request that the Secretary of State for India will be good enough to inform me when the "further reference" above alluded to was given to the Government of India, and of the exact nature of the reference which has been made to it on the subject of my claim against the late Native Government of Oudh.

I have, &c.
(signed) *Warren Hastings Leslie Frith.*

From the Under Secretary of State for India to *W. H. Frith*, Esq.; dated
India Office, 20 July 1860.

Sir,

I AM directed by Sir Charles Wood to acknowledge the receipt of your letter of the 26th ultimo, and to inform you, in reply, that until he receives an answer to the reference alluded to in Mr. Melvill's letter of the 22d ultimo, no further information can be afforded to you.

I am, &c.
(signed) *T. G. Baring.*

EAST INDIA (CAPTAIN FRITH, &c.)

RETURN to an Address of the Honourable The House of Commons,
dated 18 February 1861;—for,

“COPIES of a LETTER from Captain *Robert Frith* to Lord *Cornwallis*, dated the 19th day of October 1790, with the MINUTE of the COUNCIL at *Calcutta* thereon, and of the several EXHIBITS annexed thereto :”

“Of a LETTER from Mr. *James Lumsden*, Resident at *Lucknow*, to Mr. *G. H. Barlow*, Secretary to the Government, *Fort William*, dated the 23d day of February 1798, together with the several EXHIBITS annexed thereto :”

“Of a LETTER from the Governor General in Council of *Bengal*, to the Secret Committee of the Court of Directors, dated the 16th day of August 1787, together with the Account No. 4, referred to in and accompanying that Letter :”

“And, of any LETTER or DESPATCH from the Secretary of State for *India*, to the Governor General of *India*, during the year 1860, containing a ‘further reference’ on the subject of the several CLAIMS on the late State of *Oude*.”

India Office, }
20 March 1861. }

J. W. KAYE,
Secretary in Political Department.

(*Mr. Ayrton.*)

Ordered, by The House of Commons, to be Printed,
22 March 1861.

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EXTRACT, Bengal Political Consultations, dated 20 October
(No. 41), 1790.

From Captain *R. Frith* to Lord *Cornwallis*, the Governor General of India in
Council, dated Calcutta, 19 October 1790.

My Lord,

UNWILLING as I should be to intrude upon your Lordship's time in matters of little moment, I am well assured that where the object is of consequence to any individual, and the means of relief are with your Lordship, you do not, and will not consider any hours of your public life more worthily employed than in distributing justice, and assisting those who are entitled to the support of your Government in recovering what is strictly their due.

With this full conviction on my mind, I have no hesitation whatever in submitting my case to your decision on the merits of it, and with it the most important question to myself that I can ever lay before you; but, my Lord, the question, although it relates to me personally, and involves in it a very large sum, chiefly the property of others, to whom I stand engaged for the payment of it, is of a public nature, and in that light I bring it before your Lordship.

The records of this Government can inform your Lordship that in the year 1784, Mr. Hastings, the Governor General of this country, was vested with full power and authority by the Governor General and Council "to concert and adjust with the Nabob Vizier the means of discharging his engagements to the Company of restoring and securing the peace, safety, and order of his Government, and of promoting the improvement of his revenue, and to support the Nabob Vizier with the authority of this Government, in as full and ample manner as the Board could empower him by an Act of Parliament of Great Britain, or by any of the orders of the Honourable Court of Directors, and to take all such measures as he, the Governor General, shall think necessary for the accomplishment of these ends;" and the credentials from the Board further expressed that, "for these purposes it is hereby agreed and resolved that the Governor General shall be, and is, invested with the full power and authority of this Government (so far as we can legally delegate the same) over all the officers, civil and military, stationed or residing within the dominions of the Nabob Asoph Ul Doulah and the Province of Benares, but restricted in the exercise thereof to the dominions of the Nabob Asoph Ul Doulah and the Province of Benares aforesaid, and to the purposes above recited."

See No. 1.

In the orders of the Board to the commanding officers in his Excellency's country, dated in February 1784, they were directed (without any exception of cases) to obey all such orders and instructions as the Governor General might from that time think proper to issue to them, or to the troops under their command, in his own name, and in all respects to consider his single authority as of the same force, until the order should be revoked, as that of the Governor General and Council collectively.

As a military officer of the Company, residing within the dominions of the Vizier, I was to obey Mr. Hastings' orders, without bringing into question the occasion that directed them.

I need not, at this time, acquaint your Lordship that the late Shahzadah Mirza Jewan Bukht was received by the Governor General and the Nabob Vizier in his Excellency's territories.

On the 20th October 1784 a letter was written to me from Benares by Mr. Hastings in the following terms—(Mr. Secretary Hay has the original letter by him, and will present it to your Lordship if you wish to see it):

"I desired Major Palmer, in a letter which I wrote to him yesterday, to communicate to you a proposal from me to accept the command of the Nabob Vizier's

Vizier's battalions, which have been appointed to attend on the Prince, if the Nabob approved of their being placed under charge of an English officer. I should have been glad to have left the subject to your unbiassed determination, but an event has happened which compels me to anticipate it, and to request that, if you feel no material objection or repugnance to it, you will accept it. Mr. Wheeler's death has made it necessary for me to return to Calcutta too speedily to allow your reply time to reach me. I have therefore mentioned my wish respecting you to the Prince, and I have written to the Nabob to request his assent to it. The Prince is exceedingly pleased with it, and has added a request that your brother may also be his attendant. I shall send you a formal order for the command, and shall be happy if it suits your own inclinations. If it shall be otherwise, I shall not be displeased at your declining the charge, because I am sure that your motives will be such as, were I acquainted with them, I should approve."

I am sure that I may safely appeal to your Lordship whether any appointment could be bestowed in terms that conferred more honour on the person who received it, and whether, having (which it had) the Vizier's immediate acquiescence in it, it was not a public nomination, which on every account I was bound to accept. But, my Lord, one of the reasons that has induced me to refer to Mr. Hastings' letter, is to convince your Lordship that the command assigned to me was on my part, however eagerly accepted, yet entirely unsolicited.

On the 21st of October 1784 an official order was sent by Mr. Hastings to Lieutenant Palhill in the following terms :

See No. 2.

"I have thought proper to appoint the corps under your command to attend the Prince Mirza Jewan Bukht, Jehaunder Shah Behandur ; you are therefore to consider yourself and your corps, from this time, as his body-guard, in the same manner as you have hitherto been with me. The command, discipline, and detail of the body-guard, will continue, as at present, in yourself ; but you are to make regular returns to and obey all general orders and directions which you may receive from Captain Frith, who is to command a corps of his Excellency the Nabob Vizier's troops, on the same service.

"You will receive all further instructions that may be necessary for your guidance during this service from Major Palmer."

The official and public nature of my appointment by an authority which the orders of Government required me to obey, has thus been established. But, my Lord, it was further established, by a report made to the Council, in Mr. Hastings' Minute of the 14th January 1785, that the Nabob Vizier had provided five battalions of sepoys to replace Colonel Cumming's detachment ; that these had been lately completed and properly equipped for that service, under the direction of an officer whom the Governor General left with the Nabob for that purpose, and for attendance on the Prince, with whom they were then stationed as his guards, and that that officer was Captain Frith.

See Nos. 3, 4, 5.

If additional public evidence of the existence of my command, within the Board's knowledge, should be wanted, a reference to the papers enclosed will leave it, my Lord, beyond the possibility of doubt, even in the Government's own declaration to the Honourable Court of Directors, in their general letter, dated the 17th January 1785. The papers exhibited in the Appendix will also bear some testimony to the services which my battalions rendered to the Vizier's collections and the peace of his country. Really, my Lord, they are still in his Excellency's service, and, I have some pride in saying, if not the only useful, yet the most useful troops on his establishment.

See Nos. 6, 7, 8, 9, and 10.

After what I have had the honour to observe, after referring to papers which will show the great reform that I made in the expense of the corps, which I declare, upon my honour, was always kept effective, a reduction of not less than 10,000 rupees a month, without taking a single sepoy from the strength, I was surprised, it was impossible I should not be so, at hearing that, on Major Palmer's explanation to the Government, of the civil and military allowances of the Company's servants in the Vizier's country, among which mine was mentioned, it was declared that, "The Board know nothing of Captain Frith's appointment, and cannot therefore authorize the allowance."

See No. 7.

See No. 11.

See No. 7.

Major Palmer had acquainted the Governor General that I had no interference with the pay or bazar of the troops, nor any means whatever of making the smallest emolument beyond my stated allowance, the sum of which will appear in the following extract of Major Palmer's letter :

"Captain

" Captain Frith, commanding four battalions of sepoys, in lieu of all charges and contingencies whatever, 5,000 rupees a month."

Allow me, in this place, my Lord, to take notice of the manner in which this allowance was granted. No. 12 of the accompanying documents, which exhibits the particulars of the establishment of his Excellency's battalions when I received the command of them, including eight six-pounders, to which two twelves were afterwards added, and the reform which I proposed in the expense, having been translated into Persian, and submitted by the Resident to his Excellency for confirmation in public durbar, he was pleased to declare, in terms that were highly creditable and pleasing to me, his fullest approbation of the abatement I had made in the charges; and, as a proof of his Excellency's satisfaction, without hint or persuasion from any one on my behalf, his Excellency was pleased at once to direct that an order should be immediately recorded, granting me an allowance of 5,000 rupees a month for table allowance, or what is called, in the language of the country, khannah krutch; by which I felt and declared myself most amply rewarded for every service I could render to his Excellency, and considered it as a full allowance, to include every item or particular to be paid by his Excellency on my account.

See No. 12.

But even of this allowance I had received no part from his Excellency, when the Board refused to sanction the payment of any to me as commanding his battalions, refusing it on a ground, of the truth or justice of which your Lordship will be the judge; nor have I received any salary or consideration whatever as attendant or Resident on the part of the Company with the Shah-gada, yet my expenses in that separate office were on many accounts large. I am sure that I do not overrate them when I state them at the sum of 14,000 rupees; and I can take upon me to declare that I never received directly or indirectly from his Royal Highness any perquisite, advantages, or emolument whatever; nay, even that I declined to accept the smallest complement from him, though mine were regularly offered on particular occasions, and never charged. I can also add, my Lord, the same with respect to Lieutenant Richard Frith, who attended the Prince in my absence, and was actually appointed my assistant by Mr. Hastings, that he never received any allowance or consideration beyond his ordinary pay as an officer.

The state of the battalions when the command was assigned to me, the exertions that I made, and the difficulties I encountered to put them in discipline, and make them good troops, as they really were when I was removed from the command of them, will appear to your Lordship in the papers annexed. They suffered the greatest distress from want of pay; but I would not trouble the Vizier or his minister with complaints and representations, knowing that they were then doing their utmost to fulfil their engagements to our Government for the payment of so large a sum as one crore and 15 lakh of rupees; and I thought it my duty not only to exert my personal endeavours to keep the troops in good humour, but to use my personal credit to procure for them from time to time temporary supplies of money. My Lord, the only sum that was ever received from the Nabob's treasury or government for the troops during the period of my command was 20,000 rupees, in the month of January 1785, and the whole was immediately divided among the men of the battalions by the minister's own people, and in my presence; yet, small as this advance was, compared with the just dues of the corps, and notwithstanding many disadvantages which they likewise suffered, they marched with the greatest alacrity, on the incursion of the Sikhs into Rohileund, in February 1785; there was no murmuring, no complaint, no representation of difficulties.

See Nos. 13 and 14.

I would fain refrain from saying much about myself; but I cannot avoid upon this occasion of such interesting moment to me to observe, that your Lordship having long since visited Lucknow, and the different stations of the army, and been resident for several years in this country, must of course be possessed of the fullest information respecting the characters and conduct of the officers under your command, and that inferior as I must appear in comparison with many officers in this army, yet, as I commanded so great a corps as six battalions in the whole, in the Vizier's service, and have now in my possession many testimonies of his approbation in his public letters to the Board on my conduct, it could not be passed unobserved, and has probably been reported to your Lordship.

See Nos. 15, 16, 17,
and 18.

But to return to the immediate subject of this address, I have noticed to your Lordship the surprise with which I learned, after all that had passed, that Mr. Macpherson and Mr. Stables disavowed any knowledge of my appointment, and, in doing so, refused their sanction to the Vizier's payment of the allowances annexed to it. I thought for some time that I must have been mistaken in all that I had heard of intimations to the Board concerning my command, of letters from the Prince and the Vizier requesting its continuance, and of many flattering expressions of approbation of my conduct; and I determined, having no knowledge that I could have recourse to the Board's proceedings in this country, to obtain from England such documents as I could use in supporting my application to your Lordship. I have lately received them, and your secretary, by your Lordship's permission (for which I beg leave to offer my best acknowledgments) has attested them as accurate.

See No. 19.

Until this time, therefore, I was not prepared to state my claim fully to your Lordship's Government. It will be found in the enclosed paper, and to your justice I readily submit it, with this further remark, that the payment of the principal without the legal interest upon it will leave me greatly in debt, without the probable means of being ever able to discharge it; for the money was borrowed from the bankers Lalla Butchrange and Cashmeery Mull, and from Mr. Cockerell and Mr. Orr, and I am of course charged interest on it from the time that the loans were made to this hour.

It has occurred to me that two objections may, at first view, be urged against my claim, but I trust they cannot have weight upon due consideration.

The one is, that times have been fixed for presenting claims to Government, and I have allowed them to pass by. To this I beg leave to answer, that I was out of the way of receiving the general order that limited the period; indeed, I received no official communication whatsoever from the Government by whom, or whose order, I was not even informed until July 1786 that my command had ceased, that my claim was before the Council in May 1785, and that until now (as I have before mentioned to your Lordship) I have not had the documents that were necessary to support a rehearing of it. To this I should also add, that my first claim was on the Vizier, however much I might suppose the Company to be in honour a guarantee for the payment of dues in an office bestowed upon me by their Governor General acting under full authority from the Governor General and Council.

See No. 20.

The second objection that has occurred to me is founded on your Lordship's agreement with the Nabob Vizier in 1787. My Lord, my pretensions are entirely public; my demand is not a private demand on the Vizier; I held the command of a real and effective, not a nominal, corps of his army, and was regularly appointed to it; the Nabob Vizier will readily admit the justice of my claim. His Excellency's allowance to Lieutenant Anderson has been authorised, yet the late Government declined to sanction it when they declined to sanction mine. Captain Macleod, who commanded a corps, called the Guard of the Resident at Lucknow, has received his allowances; the pay and batta due to Lieutenant Sloper have been authorised; but Lieutenant Sloper was appointed to command a corps about the Prince's person by the same Government who thought that office useless when conferred on me.

To add to the circumstances of my cases, your Lordship will be pleased to observe that my common allowances, as an officer in the Company's service, have not been given to me; so that, in fact, while I remained upon selection in the command of a serviceable body of troops by appointment from the Governor General, in the dominions of the Vizier, I have not been permitted to receive the least pay, either from the Company, my proper employers, or the Nabob.

My Lord, permit me to repeat, that to your Lordship's consideration I submit the merits of my case. My confidence in your justice is entire. The picture of real distress requires no fiction to impress it on the feelings of a sensible mind; the language of truth must convey it fully; and in my case I have stated it in the surest conviction that a fair and candid recital of facts will constitute the best appeal to your Lordship, and afford the readiest means of obtaining that redress which all expect from that impartiality which has invariably guided your Lordship's decisions.

I have, &c.
(signed) R. Frith.

Ordered, THAT the enclosures in the above letter be entered in the Appendix.

Ordered, That a letter be written to Captain Frith, by the secretary, to acquaint him that, although the Board have a most favourable opinion of his character, it is entirely out of their power to comply with his present request. Captain Frith's claim being for arrears of pay in the Vizier's service, into which he had voluntarily entered, it can only be considered in the light of a private debt, in which the Company neither have, nor ever could have had any concern, or be justly supposed to be implicated in any responsibility, and respecting the liquidation of which it would be highly indecent and unjustifiable in this Government to interfere.

Captain Frith is at liberty to prefer his claim directly to the Vizier, upon whose pleasure alone the payment of it must depend.

(signed) *Cornwallis.*
Peter Speke.

No. 1.

Governor General's Credentials.

WHEREAS it has been resolved in Council, on the 31st of December 1783, to withdraw the Residency at Lucknow, and to invest the Governor General with a special and separate charge of the Company's affairs and interests in the dominions of the Nabob Asophul Dowlah, on certain conditions therein expressed, which have been since fulfilled: and whereas the Board have agreed, on the invitation of the Nabob Vizier, and on a tender made by the Governor General of his services in the acceptance thereof, that the Governor General shall proceed to Lucknow for the purpose of assisting the Nabob Vizier in the means of discharging his engagements to the Company, and the regulation of his Government: it is hereby resolved, that the Governor General shall be, and is, invested with full power and authority to concert and adjust with the Nabob Vizier the means of discharging his engagements to the Company, of restoring and securing the peace, safety, and order of his Government, and of promoting the improvement of his revenue; and to support the Nabob Vizier with the authority of this Government, in as full and ample manner as we can empower him by an Act of Parliament of Great Britain, or by any of the orders of the Honourable Court of Directors, and to take all such measures as he, the Governor General, shall think necessary for the accomplishments of these ends; and for these purposes it is hereby agreed and resolved, that the Governor General shall be, and is invested with the full power and authority of this Government (as far as we can legally delegate the same) over all the officers, civil or military, stationed, or residing within the dominions of the Nabob Asophul Dowlah, and the province of Benares, but restricted to the exercise thereof to the dominions of the Nabob Asophul Dowlah and the province of Benares aforesaid, and to the purposes above recited.

Given in Fort William, under the seal of the Honourable Company, and under the hands of the Governor General and Council, this 17th day of February, in the year of our Lord 1784.

(A true copy.)

(signed) *E. Hay,*
Secretary to the Government.

No. 2.

To Lieutenant *Thomas Pothill*, commanding the Body Guard of Infantry.

Sir,

Benares, 21 October 1784.

I HAVE thought proper to appoint the corps under your command to attend the Prince Mirza Jewan Bukht, Jehaander Shah Behadur; you are therefore to consider yourself and your corps from this time as his body-guard, in the same manner as you have hitherto been with me. The command, discipline, and detail of the body-guard will continue, as at present, in yourself; but you are to make regular returns to, and obey all general orders and directions which you may receive from Captain Frith, who is to command a corps of his Excellency's the Nabob Vizier's troops on the same service.

You will receive all further instructions that may be necessary for your guidance during this service, from Major Palmer.

I am, &c.
(signed) *Warren Hastings.*

No. 3.

EXTRACT from the Proceedings of the Governor General and Council in the Secret Department, on the 14th January 1785.

Governor General,

RESPECTING the question of withdrawing or continuing the corps, the Governor General informs the Board that the Nabob Vizier has provided five battalions of sepoys to replace Colonel Cumming's detachment. These have been lately completed, and properly equipped for that service, under the direction of a very able officer, whom the Governor General left with the Nabob for that purpose, and for attendance on the Prince, with whom they are at present stationed as his guards. They are to attend the Prince as far as Futtyghur, their destined station, but no further, as the Nabob cannot provide funds for raising an equivalent recruit to supply their place. This officer is Captain Frith. The Governor General did not mention his appointment to Board, in his former report relating to the Prince, because the Nabob Vizier had, at that time, signified his intentions of placing the corps under the command of a native officer, and the Governor General of course withdrew his recommendation of Captain Frith. The Nabob has since changed his intentions.

No. 4.

EXTRACT of a Letter from Major General *Giles Hibbert*, Commander-in-Chief, to the Governor General and Council; dated Fort William, 24 February 1785.

I DO myself the honour of enclosing for your information, a copy of a letter to me from Colonel Sir John Cumming, advising me of his intention to march the day after the date of that letter, with the detachment under his command, leaving one regiment of sepoys for the protection of the cantonments and magazine, till the arrival of Captain Frith, who was expected there in a short time with a battalion of the Nabob's sepoys.

No. 5.

EXTRACT of a Letter from Colonel Sir *J. Cumming*, to the Honourable the Governor General and Council; dated Futtyghur, 11 February 1785.

I HAVE the honour to inform you, that in consequence of his Excellency the Vizier's requisition, I shall march from hence to-morrow with two regiments of sepoys, the rosallah of cavalry, and the artillery; one regiment will remain here, in charge of the magazine and cantonments, until the arrival of Captain Frith with a battalion of the Nabob's sepoys, when that regiment also will proceed to join the detachment.

No. 6.

EXTRACT of a Letter from Major *Palmer* to the Honourable *John Macpherson*, Esq., Governor General, dated Lucknow, 1 April 1785, and recorded on the Secret Consultation of the Board, on the 12th of that month.

THE corps under command of Captain Frith is detached upon service and dispersed. The Vizier has judged it imprudent to reduce them in the present situation of affairs, and in fact, he has not been able hitherto to relieve the stations which they occupy, but as I had the honour to inform you before, this will be done as soon as possible. Captain Frith has great merit, both in his discipline and economy of these corps; but he does not wish that any consideration for him should for a moment impede any arrangement which you may judge for the service of either Government.

No. 7.

EXTRACT of a Letter from the Nabob Vizier to the Honourable *John Macpherson*, Esq., Governor General, received the 21st April 1785, and recorded on the Secret Consultation of the Board, the 26th of the same month.

2d. para. MR. HASTINGS wrote to me for the abolition of Captain Frith's battalions. At that time the disturbances of the Seiks existed in the neighbourhood of Bareilly, and my army was stationed at the ghauts of the river, at those places which at this season are always fordable.

This year many other ghauts were fordable, and the Seiks crossed over to plunder, which is their custom; my army, which was already there, came upon them and punished them, and they, finding no strength to remain, crossed back again and returned.

But it became necessary to guard all ghauts, and I therefore stationed for the defence of the Bareilly ghauts my old battalions that were fixed at Khyrabad and the other Mhals; and I sent the battalions of Captain Frith, which were newly raised, for the settlement
of

of the Mhals of Khyrabad, &c. These battalions went under the command of a commandant belonging to me, and no English gentleman went there. In these four battalions, according to the rule of all my battalions, there are 3,000 men, and the expense of them, including the artillery, is 25,000 rupees in each month.

For a little time I thought this expense advisable for the execution of two important objects, the settlement of the country and the expulsion of the Seiks, which, by the blessing of God, have been both effected.

I have now determined to disband them after satisfying them; but I consider it proper to guard the ghauts till Cheyte, till when the floods continue; after that, when the river be full, so large an army will not be wanted at the ghauts.

In this case I request your advice, that as this army is on a reduced and saving establishment, if you choose, I will keep the battalions until Cheyte, or if you order, I will dismiss them immediately.

Captain Frith will have no concern with the battalions.

No. 8.

EXTRACT of a Letter from the Vizier to the Governor General, received the 21st, and recorded on the Consultation of the Board the 26th of April 1785.

THE Governor General, Mr. Hastings, when he discovered my distressed situation, engaged to remove the brigade of Futtyghur, and I, from my foresight of events, got leave to retain four battalions which I had chosen for additional security, which four battalions should be stationed at Futtyghur, under the command of an officer in my confidence, and should, whenever necessary, be sent under an aumil to settle the Mhals of Saundy, &c., which are under the aumil of Khyrabad, and also some other Mhals belonging to Bareilly, &c., in that neighbourhood, and should return to Futtyghur, and the expenses of the four battalions, which consist of 3,000 men with nine guns, being fixed at 25,000 rupees in each month, are upon a reduced and saving establishment.

No. 9.

EXTRACT of a Letter from Major *Palmer* to the Honourable *John Macpherson*, Esq., dated Lucknow, 27th March 1785.

CAPTAIN Frith has diminished the expense of the corps under his command almost 10,000 rupees per month, without taking a single sepoy from the strength of them. He has no interference with their pay or bazaar, nor any means whatever of the smallest emolument beyond his stated allowance.

Captain Frith, commanding four battalions of sepoys, in lieu of all charges and contingencies whatever, 5,000 rupees per month.

No. 10.

EXTRACT of a General Letter from Bengal to the Court of Directors, dated 17th January 1785.

Para. 17. THE Governor General informed us that the Nabob Vizier had provided five battalions of sepoys to replace Colonel Cumming's detachment; that these had been lately completed and properly equipped for that service under the direction of a very able officer, Captain Frith, whom the Governor General had left with the Nabob for that purpose, and to attend on the prince, with whom these troops are at present stationed as his guard, and that they were to escort the prince as far as Futtyghur, their destined station, but no further, as the Nabob could not provide funds for raising an equivalent recruit to supply their place.

18. But the Governor General observed that, if it should be the decided opinion of the Board that the Futtyghur detachment should be continued in its station for another year, it would afford a considerable saving to the Nabob Vizier to apprise him of it, that he might disband the corps which he had appointed for its relief.

No. 11.

EXTRACT from the Proceedings of the Honourable the Governor General and Council, in their Secret Inspection Department, 3d May 1785.

CAPTAIN Frith, commanding four battalions of sepoys, in lieu of all charges and contingencies whatever, 5,000 rupees per mensem. The Board know nothing of Captain Frith's appointment, and cannot therefore authorise the allowance.

No. 12.

NABOB'S ESTABLISHMENT and ESTIMATE when Captain *Frith* received the Command. [First Battalion.]

	Rs. a. p.	Rs. a. p.
1 Commandant - - - - -	125 - -	
1 Adjutant - - - - -	45 - -	
10 Subadars - each at 40 rupees per month	400 - -	
20 Jemadars - each at 20 " " -	400 - -	
50 Havildars - each at 8 " " -	400 - -	
1 Havildar Major - - - - -	15 - -	
40 Naicks - each at 7 rupees per month	280 - -	
600 Sepoys - each at 6 " " -	3,600 - -	
10 Drummers, each at 10 " " -	100 - -	
10 Fifers - each at 10 " " -	100 - -	
1 Cymbal-man - - - - -	10 - -	
10 Trumpeters, each at 6 rupees per month	60 - -	
10 Beshties - each at 6 " " -	60 - -	
1 Head Vakeel - - - - -	15 - -	
9 Vakeels - each at 10 rupees per month	90 - -	
3 Doctors - each at 10 " " -	30 - -	
1 Sardar Vakeel - - - - -	20 - -	
1 Shroff - - - - -	15 - -	
4 Bellmen - each at 4 rupees per month	16 - -	
1 Chobdar - - - - -	8 - -	
4 Hircarrahs, each at 6 rupees per month	24 - -	
Golandaaze:		
1 Jemadar - - - - -	20 - -	
15 Golandaaze, each at 10 rupees per month	150 - -	
1 Tindal - - - - -	10 - -	
30 Lascars - each at 6 rupees per month	180 - -	
1 Mistry Carpenter - - - - -	12 - -	
7 Carpenters, each at 8 rupees per month	56 - -	
1 Mistry Smith - - - - -	15 - -	
6 Smiths - each at 8 rupees per month	48 - -	
1 Sicklagur - - - - -	5 - -	
1 Beshty - - - - -	6 - -	
1 Vakeel - - - - -	10 - -	
Artificers:		
1 Mate - - - - -	5 - -	
19 Bildars - each at Rs. 3. 8 per month	66 8 -	
154 Bullocks, including Drivers, each at 14 rupees per month	2,156 - -	
14 Hackeries - each at 45 " " -	630 - -	
TOTAL - - - Rs.	9,182 8 -	

REFORMED ESTABLISHMENT and ESTIMATE by Captain *Frith* [First Battalion.]

	Rs. a. p.	Rs. a. p.
1 Commandant - - - - -	125 - -	
10 Subadars - each at 40 rupees per month	400 - -	
20 Jemadars - each at 20 " " -	400 - -	
40 Havildars - each at 8 " " -	320 - -	
40 Naicks - each at 7 " " -	280 - -	
600 Sepoys - each at 6 " " -	3,600 - -	
4 Drummers, each at 9 " " -	36 - -	
4 Fifers - each at 9 " " -	36 - -	
8 Tom Toms, each at 6 " " -	48 - -	
10 Beshties - each at 6 " " -	60 - -	
2 Doctors - each at 10 " " -	20 - -	
2 Muttsaddies, each at 10 " " -	20 - -	
24 Coolies - each at 4 " " -	96 - -	
4 Gunymen - each at 4 " " -	16 - -	
1 Adjutant, Staff Pay (a Subadar)	16 - -	
1 Havildar Major (a Havildar) Artillery	8 - -	
		5,481 - -
1 Jemadar - - - - -	20 - -	
1 Havildar - - - - -	8 - -	
1 Naick - - - - -	7 - -	
13 Golandaaze, each at 6 rupees per month	78 - -	
1 Serang - - - - -	10 - -	
1 Tindal - - - - -	8 - -	
30 Lascars - each at 6 rupees per month	180 - -	
1 Beshty - - - - -	6 - -	
3 Smiths - each at 8 rupees per month	24 - -	
3 Carpenters, each at 8 " " -	24 - -	
6 Bildars - each at 4 " " -	24 - -	
100 Bullocks, Draft and Carriage, including Drivers, &c., feeding, and all expenses, at 12 rupees per pair -	600 - -	
2 Hackeries - - - - -	60 - -	
		1,049 - -
Retrenchment by Captain Frith's Reformed Establishment - - - - -		6,530 - -
		2,652 8 -
TOTAL - - - Rs.		9,182 8 -

NABOB'S ESTABLISHMENT and ESTIMATE when Captain *Frith* received the Command. [Second Battalion.]

	Rs. a. p.	Rs. a. p.
1 Commandant - - - - -	125 - -	
1 Adjutant - - - - -	45 - -	
10 Subadars - each at 40 rupees per month	400 - -	
20 Jemadars - each at 20 " " -	400 - -	
50 Havildars - each at 8 " " -	400 - -	
1 Havildar Major - - - - -	15 - -	
40 Naicks - each at 7 rupees per month	280 - -	
600 Sepoys - each at 6 " " -	3,600 - -	
10 Drummers, each at 10 " " -	100 - -	
10 Fifers - each at 10 " " -	100 - -	
1 Cymbal-man - - - - -	10 - -	
10 Trumpeters, each at 6 rupees per month	60 - -	
10 Beshties - each at 6 " " -	60 - -	
1 Head Vakeel - - - - -	15 - -	
9 Vakeels - each at 10 rupees per month	90 - -	
3 Doctors - each at 10 " " -	30 - -	
1 Sardar Vakeel - - - - -	20 - -	
1 Shroff - - - - -	15 - -	
4 Bellmen - each at 4 rupees per month	16 - -	
1 Chobdar - - - - -	8 - -	
4 Hircarrahs, each at 6 rupees per month	24 - -	
Golandaaze:		
1 Jemadar - - - - -	20 - -	
15 Golandaaze, each at 10 rupees per month	150 - -	
1 Tindal - - - - -	10 - -	
30 Lascars - each at 6 rupees per month	180 - -	
1 Mistry Carpenter - - - - -	12 - -	
7 Carpenters - each at 8 rupees per month	56 - -	
1 Mistry Smith - - - - -	15 - -	
6 Smiths - each at 8 rupees per month	48 - -	
1 Sicklagur - - - - -	5 - -	
1 Beshty - - - - -	6 - -	
1 Vakeel - - - - -	10 - -	
Artificers:		
1 Mate - - - - -	5 - -	
19 Bildars - each at Rs. 3. 8 per month	66 8 -	
154 Bullocks, including Drivers, each at 14 rupees per month	2,156 - -	
14 Hackeries - each at 45 " " -	630 - -	
TOTAL - - - Rs.	9,182 8 -	

REFORMED ESTABLISHMENT and ESTIMATE by Captain *Frith* [Second Battalion.]

	Rs. a. p.	Rs. a. p.
1 Commandant - - - - -	125 - -	
10 Subadars - - - - -	400 - -	
20 Jemadars - - - - -	400 - -	
40 Havildars - - - - -	320 - -	
40 Naicks - - - - -	280 - -	
600 Sepoys - - - - -	3,600 - -	
4 Drummers - - - - -	36 - -	
4 Fifers - - - - -	36 - -	
8 Tom Toms - - - - -	48 - -	
10 Beshties - - - - -	60 - -	
2 Doctors - - - - -	20 - -	
2 Muttsaddies - - - - -	20 - -	
24 Coolies - - - - -	96 - -	
4 Gunymen - - - - -	16 - -	
1 Adjutant, Staff Pay (a Subadar)	16 - -	
1 Havildar Major (a Havildar) - -	8 - -	
		5,484 - -
Artillery:		
1 Jemadar - - - - -	20 - -	
1 Havildar - - - - -	8 - -	
1 Naick - - - - -	7 - -	
13 Golandaaze - - - - -	78 - -	
1 Serang - - - - -	10 - -	
1 Tindal - - - - -	8 - -	
30 Lascars - - - - -	180 - -	
1 Beshty - - - - -	6 - -	
3 Smiths - - - - -	24 - -	
3 Carpenters - - - - -	24 - -	
6 Bildars - - - - -	24 - -	
100 Bullocks, Draft and Carriage, including Drivers, &c., feeding, and all expenses, each at 12 rupees per pair -	600 - -	
2 Hackeries - - - - -	60 - -	
		1,040 - -
Retrenchment by Captain Frith's Reformed Establishment - - - - -		6,530 - -
		2,652 8 -
TOTAL - - - Rs.		9,182 8 -

NABOB'S ESTABLISHMENT and ESTIMATE when Captain <i>Frith</i> received the Command. [Third Battalion.]				REFORMED ESTABLISHMENT and ESTIMATE by Captain <i>Frith</i> . [Third Battalion.]			
	Rs.	a.	p.		Rs.	a.	p.
1 Commandant - - - - -	125	-	-	1 Commandant - - - - -	125	-	-
1 Adjutant - - - - -	45	-	-	10 Subadars - each at 40 rupees per month	400	-	-
10 Subadars - each at 40 rupees per month	400	-	-	20 Jemadars - each at 20 " " "	400	-	-
20 Jemadars - " at 20 " " "	400	-	-	40 Havildars - each at 8 " " "	320	-	-
50 Havildars - 29 men, at 11 rupees each, and 21 " at 8 " " "	487	-	-	40 Naicks - each at 7 " " "	280	-	-
1 Havildar Major - - - - -	15	-	-	600 Sepoys - each at 6 rupees per month	3,600	-	-
40 Naicks - 4 men, each at 10 rupees per month, and 36 " each at 7 " " "	292	-	-	4 Drummers - each at 9 " " "	36	-	-
600 Sepoys - each at 6 rupees per month	3,600	-	-	4 Fifers - each at 9 " " "	36	-	-
10 Drummers, each at 10 " " "	100	-	-	8 Tom Toms - each at 6 " " "	48	-	-
10 Fifers - each at 10 " " "	100	-	-	10 Beshties - each at 6 " " "	60	-	-
1 Cymbal-man - - - - -	10	-	-	2 Doctors - each at 10 " " "	20	-	-
10 Trumpeters, each at 6 rupees per month	60	-	-	2 Mutsaddies - each at 10 " " "	20	-	-
10 Beshties - each at 6 " " "	60	-	-	24 Coolies - each at 4 " " "	96	-	-
1 Head Vakeel - - - - -	15	-	-	4 Gunymen - each at 4 " " "	16	-	-
9 Vakeels - each at 10 rupees per month	90	-	-	1 Adjutant, Staff-pay (a Subadar)	16	-	-
3 Doctors - each at 10 " " "	30	-	-	1 Havildar Major (Havildar)	8	-	-
1 Sirdar Vakeel - - - - -	20	-	-				
1 Shroff - - - - -	15	-	-				5,481 - -
4 Bellmen - each at 4 rupees per month	16	-	-	Artillery:			
1 Chobdar - - - - -	8	-	-	1 Jemadar - - - - -	20	-	-
4 Hircarrahs, each at 6 rupees per month	24	-	-	1 Havildar - - - - -	8	-	-
Golandaaze:			5,912 - -	1 Naick - - - - -	7	-	-
1 Jemadar - - - - -	20	-	-	13 Golandaaze - each at 6 rupees per month	78	-	-
15 Golandaaze, each at 10 rupees per month	150	-	-	1 Serang - - - - -	10	-	-
1 Tindal - - - - -	10	-	-	1 Tindal - - - - -	8	-	-
30 Lascars - each at 6 rupees per month	180	-	-	30 Lascars - each at 6 rupees per month	180	-	-
1 Mistry Carpenter - - - - -	12	-	-	1 Beshty - - - - -	6	-	-
7 Carpenters, each at 8 rupees per month	56	-	-	3 Smiths - each at 8 rupees per month	24	-	-
1 Mistry Smith - - - - -	15	-	-	3 Carpenters - each at 8 " " "	24	-	-
6 Smiths - each at 8 rupees per month	48	-	-	6 Bildars - each at 4 " " "	24	-	-
1 Sicklagar - - - - -	5	-	-	100 Bullocks, draft and carriage, including Drivers, &c., feeding, and all expenses, at 12 rupees per pair	600	-	-
1 Beshty - - - - -	6	-	-	2 Hackeries - - - - -	60	-	-
1 Vakeel - - - - -	10	-	-				1,049 - -
Artificers:			512 - -				6,530 - -
1 Mate - - - - -	5	-	-	Retrenchment by Captain <i>Frith</i> 's Reformed Estab-			
19 Bildars - each at Rs. 3. 8 per month	66	8	-	lishment			
14 Bullocks, including Drivers, each at 14 rupees per month	2,156	-	-				2,751 8 -
14 Hackeries, including Drivers, each at 45 rupees per month	630	-	-				
			2,857 8 -				
TOTAL - - - - -	Rs.	9,281	8 -	TOTAL - - - - -	Rs.	9,281	8 -

NABOB'S ESTABLISHMENT and ESTIMATE when Captain <i>Frith</i> received the Command. [Fourth Battalion.]				REFORMED ESTABLISHMENT and ESTIMATE by Captain <i>Frith</i> . [Fourth Battalion.]			
	Rs.	a.	p.		Rs.	a.	p.
1 Commandant - - - - -	125	-	-	1 Commandant - - - - -	125	-	-
1 Adjutant - - - - -	45	-	-	10 Subadars - each at 40 rupees per month	400	-	-
10 Subadars - each at 40 rupees per month	400	-	-	20 Jemadars - each at 20 " " "	400	-	-
20 Jemadars - each at 20 " " "	400	-	-	40 Havildars - each at 8 " " "	320	-	-
50 Havildars - 29 men, at 11 rupees each, and 21 at 8 rupees per month	487	-	-	40 Naicks - each at 7 " " "	280	-	-
1 Havildar Major - - - - -	15	-	-	600 Sepoys - each at 6 " " "	3,600	-	-
40 Naicks - 4 men each, at 10 rupees, and 36 at 7 rupees per month	292	-	-	4 Drummers, each at 9 " " "	36	-	-
600 Sepoys - each at 6 rupees per month	3,600	-	-	4 Fifers - each at 9 " " "	36	-	-
10 Drummers, each at 10 " " "	100	-	-	8 Tom Toms, each at 6 " " "	48	-	-
10 Fifers - each at 10 " " "	100	-	-	10 Beshties - each at 6 " " "	60	-	-
1 Cymbal-man - - - - -	10	-	-	2 Doctors - each at 10 " " "	20	-	-
10 Trumpeters, each at 6 rupees per month	60	-	-	2 Mutsaddies, each at 10 " " "	20	-	-
10 Beshties - each at 6 " " "	60	-	-	24 Coolies - each at 4 " " "	96	-	-
1 Head Vakeel - - - - -	15	-	-	4 Gunymen, each at 4 " " "	16	-	-
9 Vakeels - each at 10 rupees per month	90	-	-	1 Adjutant, Staff-pay (a Subadar)	16	-	-
3 Doctors - each at 10 " " "	30	-	-	1 Havildar Major (Havildar)	8	-	-
1 Sirdar Vakeel - - - - -	20	-	-				5,481 - -
1 Shroff - - - - -	15	-	-				
4 Bellmen - each at 4 rupees per month	16	-	-	Artillery:			
1 Chobdar - - - - -	8	-	-	1 Jemadar - - - - -	20	-	-
4 Hircarrahs, each at 6 rupees per month	24	-	-	1 Havildar - - - - -	8	-	-
Golandaaze:			5,912 - -	1 Naick - - - - -	7	-	-
1 Jemadar - - - - -	20	-	-	13 Golandaaze - each at 6 rupees per month	78	-	-
15 Golandaaze, each at 10 rupees per month	150	-	-	1 Serang - - - - -	10	-	-
1 Tindal - - - - -	10	-	-	1 Tindal - - - - -	8	-	-
30 Lascars - each at 6 rupees per month	180	-	-	30 Lascars - each at 6 rupees per month	180	-	-
1 Mistry Carpenter - - - - -	12	-	-	1 Beshty - - - - -	6	-	-
7 Carpenters, each at 8 rupees per month	56	-	-	3 Smiths - each at 8 rupees per month	24	-	-
1 Mistry Smith - - - - -	15	-	-	3 Carpenters - each at 8 " " "	24	-	-
6 Smiths - each at 8 rupees per month	48	-	-	6 Bildars - each at 4 " " "	24	-	-
1 Sicklagar - - - - -	5	-	-	100 Bullocks, draught and carriage, including Drivers, &c., feeding, and all expenses, at 12 rupees per pair	600	-	-
1 Beshty - - - - -	6	-	-	2 Hackeries - - - - -	60	-	-
1 Vakeel - - - - -	10	-	-				1,049 - -
Artificers:			512 - -				6,530 - -
1 Mate - - - - -	5	-	-	Retrenchment by Captain <i>Frith</i> 's reformed Estab-			
19 Bildars - each at Rs. 3. 8 per month	66	8	-	lishment			
14 Bullocks, including Drivers, each at 14 rupees per month	2,156	-	-				2,751 8 -
14 Hackeries - each at 45 " " "	630	-	-				
			2,857 - -				
TOTAL - - - - -	Rs.	9,281	8 -	TOTAL - - - - -	Rs.	9,281	8 -

No. 12.—COMPARATIVE VIEW.

NABOB'S ESTABLISHMENT.					REFORMED ESTABLISHMENT by Captain <i>Frith</i> .				

No. 13.

Honourable Sir,

Camp, near Lucknow, 1 December 1784.

THE desire of being able to make a correct report of the Nabob Vizier's battalions prevented me troubling you with a letter upon that subject, immediately upon my receiving the command, or before I was enabled by a particular inspection, personally to ascertain the true state of them. In the mean time, I hope you will not have considered me guilty of negligence in so material a point of duty. The present state of the corps, ordnance, stores, arms, accoutrements, &c., which I have now the honour to lay before you, is the result of many days' strict investigation by myself.

The battalions were delivered to me complete, with respect to numbers, according to the Vizier's establishment; but as they must have been collected for the purpose in the space of a few days, they are generally made up of such miserable half-starved wretches as Lucknow and its environs abounded with. This, however, a very little time, and some good feeding, will obviate in those that are fit to be kept, and as I have it in my power every day to choose out of some hundred volunteers that are constantly offering themselves, I shall find no difficulty in completing them with choice men.

The officers have mostly been promoted from inferior ranks, and many, from never before having held any military rank at all, by the sole influence of three or four of the Nabob's orderlies; therefore, no great service or even assistance can be expected from them for a little time. But I hope three hours' close attention every morning, and two hours every evening, will very soon bring them and the whole of the corps into tolerable good order, which every endeavour of mine shall be exerted to effect. With respect to guns, arms, accoutrements, &c., I have, in the report of them, said as little as possible, considering their real state, to avoid every idea of making difficulties. Major Palmer was present at the time I received the command, and saw the state of the whole. He did not wait for my report of it, to represent to the Minister the necessity of having the detachment properly equipped; in consequence of which, I have this day received an order directed to Colonel Martin for the exchange of the guns, as well as the delivery of all manner of stores that I am in want of, which can be supplied from the arsenal.

The Nabob has 4,000 stands of European arms in his own magazine at Lucknow, and I hope will be induced to order the exchange of the firelocks, &c., in the course of a few days, as the Prince constantly expresses his wishes to see the battalions armed, and in all respects look like "English Sepoys."

(signed) *Rt. Frith.*

No. 14.

To Major *Palmer*.

20 December 1784.

MY anxiety to be in some degree of readiness to move when you called upon me to trouble you with such information as I have collected respecting the money at present required by the battalions.

I find, in the first place, that the officers and men have claims for about 10,000 rupees of arrears due to them in the Nabob's old corps, from whence most of the officers, and many of the men, were drafted when these battalions were formed; however, this is a business that I conceive I can properly have no concern with, and I have told the people that I can do no more in it than merely to mention it to you, and that I imagined you could

could only do as much to the Minister; at the same time, as they particularly requested I would do so much, I thought I could not well refuse them.

From the time that these battalions were formed until I received the command of them, it appears by their accounts (which are, however, too perplexed to be just now

to you) that each corps has received about 2,000 rupees for subsistence; which statement leaves a balance due to the whole from the 26th August, the date of their formation, until the 1st of December, of about 53,000 rupees, and to this may be added in a few days more, the abstracts for the month of December. Altogether, I think if one lac of rupees could now be spared, it would nearly be sufficient to clear off all demands up to the 1st of January 1785, and we might then afford not to be troublesome for two or three months to come.

The distribution of this sum, my dear Palmer, just at the commencement of my command, would be most fortunate for me, as it will establish my credit with the troops, conciliate their confidence, and ensure future obedience to and dependence upon me; at all events, whatever sum you can procure for me, you may most confidently rely upon the just and faithful application of it, and in the present state of the people, I may venture to say that almost any assistance of money will be acceptable.

(signed) *Rt. Frith.*

No. 15.

From the Prince to Mr. *Macpherson*, Governor General.—Received 14 June 1785.

My friend, Ameer Ummomalik Amaud-ud-Dowla, Mr. Hastings, Bahader Jelladut Jung, had placed Captain Robert Frith with his brother in the presence that they should attend upon my royal stirrup, and five battalions of my brother the Vizier of the Empire, which were stationed at the presence, had been placed under the said captain. At this time, the said battalions have been appointed for the management of different districts; therefore, the said Captain is going to you, and his younger brother is attending in the presence, as I am pleased with the attachment and allegiance of the said captain; therefore I write to you that, having given confidence to the said captain, you send him back to the presence, because the attendance of these few Englishmen gives respect to the presence, and by this consider me to be greatly pleased. Whatever the said captain may make known to you for the arrangement of my concerns, you will listen thereto with the ear of your heart.

No. 16.

From the Prince to Mr. *Macpherson*, Governor General.—Received 17 July 1786.

WHEN I came to this quarter from Delhi, and arrived in these provinces, and Mr. Hastings made me happy by the performance of the duties of attachment and allegiance, he placed my faithful servants, Captain Robert Frith and Lieutenant Richard Frith, at my presence, that they should attend in service, and I was perfectly pleased with the good conduct of the said gentlemen. It is now reported that you have recalled these gentlemen; I therefore write that you are more employed than Mr. Hastings in giving me satisfaction, and God knows and is witness that I am perfectly pleased and satisfied with the proofs of your attachment. Such were the exertions of former Amras in the service of former kings which are in the annals of the world, as your attachment and allegiance are recorded in my heart. I therefore write that such a recall of these gentlemen from the presence is cause of discredit to them among the English gentlemen, and I also am astonished at the circumstance why you should have recalled them from their attendance in the presence, since neither loss came to the Company, nor did they receive anything from the Vizier. It is therefore necessary that you speedily send back Mr. Richard Frith, who is gone to Calcutta in obedience to your recall, that he may attend at my presence. This will certainly give me satisfaction; and as Captain Robert Frith, who is also gone in obedience to your recall, is much experienced in business, I therefore write that when you shall place the battalions with me again, you will choose him for the command of them, because the circumstance will give me pleasure.

No. 17.

From the Prince to Mr. *Macpherson*, Governor General.—Received 18 July 1785.

AT this time writings have arrived from the Royal presence, copies of which, translated into English, are sent through Captain Frith for your information. The wish and desire of his Majesty is, that the English gentlemen and the Viziers Ulmamoolik should execute

services for the Royal presence. Mr. Hastings had in view the supporting the dignity of the throne, and the performing services for the Royal person; and now the proofs of the same desire are expected from you, because your allegiance and attachment are beyond bounds established at the Royal presence, and you are in wisdom and prudence the Aristotle of the age. One word to the wise is equal to whole volumes. In this business you should make such a plan that the prosperity of the affairs of Royalty may properly take place, and that you may acquire reputation for the present and for ever therefrom. Mr. Hastings fixed Captain Robert Frith with his younger brother at the Royal presence. They are well-wishers to the presence, and attached to you; and I have sent Captain Frith to you on the business of the Sircar alone, after giving him complete satisfaction. Send him soon back to the presence, that I may receive pleasure therefrom, and appoint him, that he may apply himself with ease of mind to the performance of duty to the presence, and that he may perform his services.

No. 18.

From the Prince to the Right Honourable Earl *Cornwallis*, Governor General, &c. &c.
—Received 17 October 1786.

At this fortunate time it has come to my hearing that my uncle, his sacred Majesty, from your wisdom and great penetration, has sent you for the Government of Bengal, &c. From learning this circumstance my heart has become highly pleased and joyous. You will have learnt the accounts of me in the provinces, from the time of my arrival until now, from the mouth of Mr. Hastings, who was firm in sincere intention towards the presence, and has performed the best services; and you will also hear this from Mr. Macpherson, who with the greatest attachment is performing services.

Mr. Hastings has a very great friendship for Captain Robert Frith, and placed him near me with five battalions, and his brother to attend upon me, and the said gentlemen having disciplined the said battalions, were from their heart and soul ready in obedience to me. In the meantime Mr. Hastings went to Europe, from which cause soon after, by the advice of the Council at Calcutta, the command of the battalions was taken from the captain; and his brother was summoned to Calcutta. I am entirely ignorant why these appointments were taken away from the two brothers; accordingly the said captain will mention all these particulars; I am certain that you, a Noble Peer, will, as formerly, appoint the said captain to the command of the battalions, and order his brother to attend upon me, and will send them hither, because the said captain is very attentive to the discipline and good state of the battalions.

Secondly: for some time his Majesty, Shah Allum, my rightful lord and director, cannot settle as he would wish the country of Delhi, &c., without an army, therefore I have this object also in my mind, that his Majesty's pleasure and the reputation of me and you, and of the Company and King of England, may be made plain and visible to all the world. In case of delay, I will quit Lucknow, and, arriving at Calcutta, will make myself happy by a personal interview. I write for your information.

No. 19.

His Excellency the Nabob Vizier.

		Rs.
1790.	The amount of a bond - - - - -	1,00,000
1785.	Interest on ditto from July to the end of September	
	1790, five years and three months, at 12 per cent.	63,000
	Amount of allowance from July 1785 till July 1786,	
	at 5,000 rupees per month - - - - -	60,000
	<i>Lw. Sic. Rs.</i>	2,23,000

It is to be observed that no interest is calculated upon the amount of the allowances, although, in fact, it is equally due; and would, from July 1785 to the present time, augment the last article to 90,000 rupees (*i.e.*, interest on 60,000 rupees for four years and a quarter, being upwards of 30,000 rupees.)

In part payment of the above, the Nabob Vizier has granted a tunkwa for 1,00,000 rupees, which, when realised, will of course be brought to credit and set off against this demand.

(signed) *R. Frith.*

No. 20.

EXTRACT of a Letter from the Honourable the Governor General and Council, in their Secret Department of Inspection, to the Honourable the Court of Directors, dated 31 July 1785.

Para. 8. THE Governor General's agent has been directed to acquaint the Vizier that the salaries paid to Lieutenant Anderson, resident with Mahajee Sindia, to Captain Frith, to Mr. Gall, assistant to the Auditor General, and to Mr. Orr, assistant to Mr. Wombwell, cannot be authorised.

EXTRACT Bengal Political Consultations, dated 5 March 1798.

No. 1.

From *J. Lumsden*, Resident at Lucknow, to *G. H. Barlow*, Esq., Secretary to the Government, Fort William.

Sir,

By the direction of the Honourable the Governor General, I transmit to you the under-mentioned papers for record :

Draft of a letter from the Governor General, to the Resident at Lucknow,ⁿ dated 5th February.

Letter from the Magistrate at Jounpore, to the Governor General, dated 19th February.

Letter from Major Robert Frith to the Governor General, dated 3d February.

Three enclosures in ditto.

Letter from Mr. Robert Grant to ditto, dated 8th February.

Eight English and one Persian enclosure in ditto.

Draft of the Governor General's answers to Major Frith and Mr. Grant.

The Persian enclosure in Mr. Grant's letter, appearing to be an original bond under the seal of the Nabob Vizier to Mr. Grant, it should, I presume, be returned to him. It will be found in No. 2 of the English enclosures.

Lucknow,
23 February 1798.

I have, &c.
(signed) *J. Lumsden*,
Resident.

No. 2.

To *John Lumsden*, Esq., Resident at Lucknow.

Sir,

IN consideration of the strong claims which the family of the late Nabob Muiktar-ud-Dowlah have upon the Company, and the distresses under which they at present labour, I have consented, on the application of Ekbaul-ud-Dowlah, the present representative of the family, to allow him a pension of one thousand Lucknow Sicca Rupees per mensem for their use, and you are accordingly authorised to advance the sum monthly from the Lucknow Treasury on his receipt.

The pension is to commence from the 1st of the present month.

Lucknow,
5 February 1798.

I am, &c.
(signed) *J. Shore*.

No. 3.

To the Honourable Sir *John Shore*, Bart., Governor General, &c. &c.,
Lucknow.

Honourable Sir,

I HAVE now the honour to inform you of the safe arrival of the late Nabob Vizier, Ally Khan, this morning at Jounpore, and that he intends to halt one day longer, to-morrow, and to proceed on the day following, by easy stages, the remainder of the journey to Benares.

In compliance with your directions, I have shown him every attention, and shall be careful, by every means in my power, to contribute to his satisfaction and convenience during the time he may continue to remain here.

Zillah, Jounpore,
19th February 1798.

I have, &c.
(signed) *A. Willand*,
Magistrate.

No. 4.

To the Honourable Sir *John Shore*, Bart., Governor General in Council,
&c. &c.

Honourable Sir,

I TAKE the liberty of submitting to your consideration a short statement of my demand against his Excellency the late Nabob Vizier, and persuade myself it will be received with an indulgence proportioned to the urgency of the necessity that compels me to intrude it on your notice.

The unexampled hardships I have suffered, and am still labouring under, from the delay in the settlement of this account will, I am confident, have its due weight with you; for the present permit me briefly to state, that debts which I contracted to carry on his Excellency's service, while in the command of a corps of five battalions at Lucknow, are still due to a very considerable amount to the houses of Butch Raji and the late Kashmery Mull, beside about 60,000 rupees in Calcutta, and that these debts are running on at an interest of 12 per cent., which my prospects in the service give me little hope of ever being able to liquidate, unless I realise those claims. This accumulating burthen hangs heavy on my mind. However, when I reflect on the nature of the debts which were lately investigated and paid, and compare them with my own—the one an accumulation of interest upon interest, the other an honourable allowance granted to an officer in a command of high importance, and for money *bond fide* expended for the public service—I feel a perfect confidence that you will give my claim that degree of consideration it in equity merits, and that it will obtain its due place amongst the other demands on the Lucknow Government, and be early brought into a course of liquidation.

It may be proper here to observe that while I commanded the battalions in his late Excellency's service, I never received one rupee, either on account of the allowance he was pleased to grant me, or of the money I advanced the sepoys, or for the feeding or other expenses of the bullocks belonging to the train of artillery attached to the corps under my command, and that these items alone form the principal of the demand.

It is with some hesitation, Honourable Sir, I venture to mention the circumstance which has principally influenced me to solicit your interference in my behalf in the present business, but it is of a nature that will, I trust, plead best its own excuse.

A constitution shattered and impaired by a long service in this climate, and repeated attacks of ill health, as well as the advice of all my medical friends, have strongly impressed the necessity on my mind of availing myself of the indulgence of a visit to Europe as early as possible; but involved in embarrass-
ments

ments as I am at present, and without the means of defraying the indispensable expenses of the voyage, I have been obliged to procrastinate, and must ultimately relinquish the design, be the consequences what they may, unless I obtain an adjustment of my demands on the Lucknow Government. Thus situated I look confidently to your justice for a favourable consideration of my claims.

Camp near Lucknow,
3 February 1798.

I have, &c.
(signed) *R. Frith.*

P. S.—The accompanying extract of the proceedings of Government, upon a claim on the late Vizier in all respects very similar to mine, will I trust be considered as an admissible precedent for a liberal interference of your honourable Board on this occasion.

No. 5.

Dr.			His Excellency the late Nabob Vizier in Account with Major <i>Robert Frith</i> and others.			Cr.		
1785.						1789.		
31 July	To amount of his Excellency's bond to Major Frith and others, dated 31st July 1785 -	Rs. 2,70,000					By a Junkha on the Nabob of Ferrukabad for lack of rupees, payable as follows:	
	Deduct Mr. R. Grant's share of this bond transferred to his account - Rs. 80,000						Rs.	
	Ditto, R. Bruce, esq., ditto - 22,000						First kist in 1789-90 for -	30,000
	Ditto, Col. Palmer's, esq., ditto - 18,000						Second ditto in 1790-91 for -	35,000
		1,20,000					Third ditto in 1791-92 for -	35,000
			1,50,000	-	-			1,00,000 - -
	To interest on 1,50,000 rupees, from the 1st August 1785 to the 31st January 1798, being 12 years and 6 months, at 12 per cent. per annum -		2,25,000	-	-		By interest on the 1st kist, made up to the 31st July 1792, per Interest Account, No. 1 -	8,605 - -
	To my monthly allowances in lieu of pay and all emoluments as commanding officer of a corps of five battalions of sepoys in his Excellency's service, from the 31st July 1785 to the 31st July 1786, when recalled to my duty in the Company's service, at 5,000 rupees per month -		60,000	-	-		By ditto on 2d kist, per ditto No. 2 -	5,811 8 -
	To interest on ditto from the 1st August 1786 to the 31st January 1798, being 11 years and 6 months, at 12 per cent. per annum -		82,800	-	-		By ditto on 3d kist, per ditto No. 3 -	1,925 - -
								16,341 8 -
							By interest on one lac of rupees received as above from the 1st of August 1792 to the 31st of January 1798, being five years and 6 months, at 12 per cent. per annum -	66,000 - -
							<i>L. Rs.</i>	1,82,341 8 -
							By balance due Major Robert Frith 31st January 1798 -	3,35,458 8 -
	TOTAL - Lucknow Sicca Rs.		5,17,800	-	-		TOTAL - Lucknow Sicca Rs.	5,17,800 - -

1st N.B.—Major Frith's share of the bond for 2,70,000 rupees arose from an allowance of 5,000 rupees granted to him by the late Vizier, on the command of five battalions of sepoys being conferred on him in lieu of all emoluments; from money advanced to the battalions by Butch Raji and Kashmery Mull on his credit, and for feeding and other expenses of the gun bullocks of the artillery attached to the battalions. The account of the whole was made up to the 31st of July 1785, approved of, and the bond granted.

2d N.B.—A bond for 40,000 rupees, in part of the 60,000 rupees above charged, was offered Major Frith, but rejected because the full amount of his allowances was not included. An attested copy of this bond forthcoming, as the original bond for 2,70,000 rupees.

Lucknow, 31 January 1798.

(signed) *R. Frith.*

No. 6.

(Enclosure, No. 1.)

INTEREST on the First Year's Kist of the Nawab Vizier's Junkha on the Nawaub of Furruckabad, granted to Captain *Robert Frith*, calculated from the day the several Sums were received to the 31st July 1792.

		Rs. a. p.
1789.		
15 December -	Interest on 5,000 rupees received this day to the 31st July 1790, being 7½ months, at 12 per cent. per annum -	375 - -
1790.		
15 January -	Interest on 3,000 rupees received this day to the 31st July 1790, being 6½ months, at 12 per cent. per annum -	195 - -
15 February -	Interest on 7,060 rupees received this day to the 31st July, being 5½ months, at 12 per cent. per annum -	385 - -
15 March -	Interest on 3,750 rupees received this day to the 31st July, being 4½ months, at 12 per cent. per annum -	168 12 -
15 April -	Interest on 3,750 rupees received this day to the 31st July, being 3½ months, at 12 per cent. per annum -	131 4 -
15 May -	Interest on 3,750 rupees received this day to the 31st July, being 2½ months, at 12 per cent. per annum -	93 12 -
15 June -	Interest on 3,750 rupees received this day to the 31st July, being 1½ months, at 12 per cent. per annum -	56 4 -
1792.		
31 July -	TOTAL Interest to the 31st July 1790 - - - Interest on 30,000 rupees, from 1st August 1790 to the 31st July 1792, being 2 years, at 12 per cent. per annum - - -	1,405 - - 7,200 - -
	TOTAL Interest on the first kist to the } - Lucknow Sicca Rs. 31st July 1792 - - - }	8,605 - -

The amount, as above, carried to the credit of his Excellency the Nawab Vizier.

(E. E.)

(signed) *R. Frith.*

(Enclosure, No. 2.)

INTEREST on the Second Year's Kist of the Nawaub Vizier's Junkha on the Nawaub of Ferrukhabad, granted to Captain *Robert Frith*, calculated from the day the several sums were received to the 31st July 1792.

		Rs. a. p.
1790.		
1 November -	Interest on 2,100 rupees received this day to the 31st July 1791, being 9 months, at 12 per cent. per annum -	189 - -
1 December -	Interest on 3,500 rupees received this day to the 31st July 1791, being 8 months, at 12 per cent. per annum -	280 - -
1791.		
1 January -	Interest on 4,000 rupees received this day to the 31st July, being 7 months, at 12 per cent. per annum -	280 - -
1 February -	Interest on 3,000 rupees received this day to the 31st July, being 6 months, at 12 per cent. per annum -	180 - -
1 March -	Interest on 4,900 rupees received this day to the 31st July, being 5 months, at 12 per cent. per annum -	245 - -
1 April -	Interest on 4,375 rupees received this day to the 31st July, being 4 months, at 12 per cent. per annum -	175 - -
1 May -	Interest on 4,375 rupees received this day to the 31st July, being 3 months, at 12 per cent. per annum -	131 4 -
1 June -	Interest on 4,375 rupees received this day to the 31st July, being 2 months, at 12 per cent. per annum -	87 8 -
1 July -	Interest on 4,375 rupees received this day to the 31st July, being 1 month, at 12 per cent. per annum -	43 18 -
1792.		
1 August -	TOTAL Interest to the 31st July 1791 - Lucknow Sicca Rs. Interest on 35,000 rupees, from 1st August 1791 to the 31st July 1792, being 1 year, at 12 per cent. per annum - - -	1,611 8 - 4,200 - -
	TOTAL Interest on the 2d kist to the 31st July 1792 - - - } only - Lucknow Sicca Rs.	5,811 8 -

The amount, as above, carried to the credit of his Excellency the Nawab Vizier.

(signed) *R. Frith.*

(Enclosure No. 3).

INTEREST on the Third Year's Kist of the Nawaub Vizier's Tuukha on the Nawab of Furrukhabad, granted to Captain *Robert Frith*, calculated from the day the several Sums were received to the 31st July 1792.

		Rs.	a.	p.
1791.				
1 October	- Interest on 3,500 rupees received this day to the 31st July, being 10 months, at 12 per cent. per annum - - - - -	350	-	-
1 November	- Interest on 3,500 rupees received this day to the 31st July 1792, being 9 months, at 12 per cent. per annum - - - - -	315	-	-
1 December	- Interest on 3,500 rupees received this day to the 31st July 1792, being 8 months, at 12 per cent. per annum - - - - -	280	-	-
1792.				
1 January	- Interest on 3,500 rupees received this day to the 31st July, being 7 months, at 12 per cent. per annum - - - - -	245	-	-
1 February	- Interest on 3,500 rupees received this day to the 31st July, being 6 months, at 12 per cent. per annum - - - - -	210	-	-
1 March	- Interest on 3,500 rupees received this day to the 31st July, being 5 months, at 12 per cent. per annum - - - - -	175	-	-
1 April	- Interest on 3,500 rupees received this day to the 31st July, being 4 months, at 12 per cent. per annum - - - - -	140	-	-
1 May	- Interest on 3,500 rupees received this day to the 31st July, being 3 months, at 12 per cent. per annum - - - - -	105	-	-
1 June	- Interest on 3,500 rupees received this day to the 31st July, being 2 months, at 12 per cent. per annum - - - - -	70	-	-
1 July	- Interest on 3,500 rupees received this day to the 31st July, being 1 month, at 12 per cent. per annum - - - - -	35	-	-
TOTAL Interest on the third year's kist to the 31st July 1792 - } - Lucknow Sicca Rs.		1,925	-	-

The amount as above carried to the credit of his Excellency the Nawaub Vizier.

(signed) *R. Frith.*

No. 7.

EXTRACT of Bengal General Consultations, the 6th of April 1778.

COLONEL GODDARD having sent in the following application, it was circulated with the Minute from the Governor General, which follows it:

Gentlemen,

Understanding that I am ordered upon service with the detachment under Colonel Leslie, I beg leave, previous to my departure, to solicit your interference respecting my claim on the Vizier, and I flatter myself, when you shall be made acquainted with the nature of it, and the particular circumstances attending it, you will be pleased to recommend to his Excellency the immediate payment of the amount due.

Upon my arrival at Lucnow to take upon me the command of the Vizier's troops, I received an order, publicly transmitted me through the Resident, Mr. Bristow, to purchase 565 horses to the corps of cavalry, and proposing to allow me 600 rupees as the price of each horse. In consequence of which I sent Lieutenant Collins to Jasnaghur, and instructed him to spare no expense in fulfilling the Vizier's directions.

I have thus, gentlemen, explained to you the nature of the Vizier's debt to me, which you will perceive was for disbursements made on account of the public service, and in obedience to his positive injunctions.

Upon the delivery of the horses, owing to the reduced state of the Nabob's treasury, I was constrained to accept of his bond for the amount of my demand, and as I considered this as a settlement of accounts with him, I am at present unprepared to lay before your Honourable Board an exact statement of the charge incurred, or the sums actually disbursed in this transaction. The Nabob's original bond, with his letter directing me to purchase the horses, I have left at Lucnow, and all the other papers relative to this business are in the pos-

session of Lieutenants Park and Collins, who had the management of it. I can, however, venture to assure the Board that, upon a general calculation, the profit made upon the purchase of each horse, including the price of feeding, &c., did not exceed 200 rupees, which is very little more than 33 per cent., and if, in contrast to this advantage, is opposed the risk of remittances and the hazard and danger to which I was subjected from the obstructions and delay Lieutenant Collins met with on his return to Ferrukhabad, when with difficulty he escaped being plundered by the numerous banditti infesting the road of everything he had with him, I am persuaded the Honourable Board will consider the profit above-mentioned exceedingly moderate and reasonable, and comply with the request I have urged in the former part of my letter respecting it.

I beg leave further to observe, that the money I advanced for this service was very considerable, that I experience much inconvenience from its remaining so long unsettled, and am paying high interest for the sums borrowed to accomplish this precarious undertaking; besides that the gentlemen who lent them are very urgent to receive some security for their repayment before I proceed upon the expedition.

I have, &c.

2 April 1778.

(signed) *Thos. Goddard.*

Governor General,

THE interposition of the Board for the recovery of the debts due from the Nabob to individuals is irregular and unprecedented; yet as those which have arisen on the account of a service which was in effect that of the Company, although in appearance the Nabob's, are in number and magnitude very considerable, and must in the end force the attention of this Government, I am willing, on the occasion of Lieutenant Colonel Goddard's application, as well as in consideration of his being detained from the service to which he has been appointed, by the personal embarrassments to which he is subjected by the unsettled state of his accounts, to recommend his claim to the consideration of the Board.

As this instance will probably fix the principles on which all the claims of a similar nature will be decided, the Board will probably judge it necessary to weigh attentively every circumstance under which those debts have been contracted, and rather incline to the preservation of the Nabob's property than the profits of his creditors, without regard to specific engagements, if these shall appear to have been disproportioned to the services for which they were intended as the recompenses, remembering that their assistance is optional, and that they have a just ground to dictate the conditions under which it shall be granted, or leave the solicitors to seek their own remedy in the Nabob's justice.

The candour with which Colonel Goddard has stated the nature of his demand, and the profits derived from his contract, entitles him to the indulgence of the Board; and this, with the reasons above-mentioned, induces me to recommend their interference for the recovery of such part of his demand as the Board, on mature consideration of the circumstances, shall judge to be duly established.

To enable the Board to determine this, I think Colonel Goddard should be required to deliver in to the Resident, upon honour, an account of the sum actually disbursed for the purchase of the horses, the charges of feeding and transporting them to Ferokhabad, the interest on the money advanced, the loss by exchange, and every other charge incidental to his contract. That a commission of — per cent. be allowed Colonel Goddard on the amount of the disbursements thus stated, in lieu of the engagement made with the Nabob, as a full compensation for his trouble; that his commission be added to the amount of the aforesaid disbursements, and bear an interest of 10 per cent. from the day of the date of the bond given Colonel Goddard by the Nabob, which is to be immediately cancelled; that Mr. Middleton be directed, on Colonel Goddard's compliance with these requisitions, to make application to the Nabob, in the name of the Board, for the payment of Colonel Goddard's demand, either by ready money or by an assignment on the unappropriated tuncaws.

(signed) *Warren Hastings.*

THE other members of the Board delivered their sentiments in the following minutes:—

Mr. BARWELL.—The proposition from the chair is founded on equity and just regard to its object; for if the influence of the Company is to be ultimately engaged for the discharge of debts, stated by our officers against the Vizier, the manner in which those arose and have accumulated ought to be submitted to the Board previous to any steps taken for their liquidation. I have no objection, under the Governor General's strictures, to direct the Resident at the Court of Oude to apply for payment of the colonel's demand as soon as it shall be approved and fixed by the standard proposed.

(signed) *Richard Barwell.*

Fort William, 3 April 1778.

Mr. FRANCIS.—By the original plan the horses of Captain Webber's and Captain Marsack's regiment were to have been raised by their respective captains; Lieutenant Colonel Goddard, who commanded the whole corps, and who was the proper check over the execution of every branch of the service, ought not to have been concerned in the purchase of the horses.

At all events there can be no just reason for adjusting his claims on this account before those of Major Webber, whose regiment was completed long before that of Captain Marsack's, and received long ago by Colonel Goddard, and reported fit for service.

I think that the two claims should be taken up in the specific terms of their respective engagements, and adjusted at the same time; the same rule, at least, should be applied equally and impartially to both cases.

(signed) *S. Francis.*

Mr. WHEELER.—I agree with Mr. Francis that the two claims should be taken up in the specific terms of their respective engagements, and adjusted at the same time, and that the same rule should be applied equally and impartially to both cases.

(signed) *Edward Wheeler.*

The propositions made on Lieutenant Colonel Goddard's letter by the Governor General being agreed to by the Board:

The secretary informs the Board that he has notified the purport of them accordingly to Colonel Goddard.

No. 8.

To the Honourable Sir *John Shore*, Bart., Governor General in Council,
&c. &c.

Honourable Sir,

LABOURING under the severe effects of your displeasure, it is with infinite pain and great diffidence I venture to come forward and intrude myself on your notice, but am compelled to it by obligations to my creditors and the duty I owe my family; nor would it be doing justice to the sense I entertain of your clemency and impartiality if I suffered myself to be withheld from laying my claims before you by any idea that my misfortunes would operate against them, or that they would not meet with that consideration which they in equity merit.

Relying confidently, honourable sir, on that impartial and discriminating justice which forms so prominent a feature in your government, I take the liberty of submitting to your consideration the accompanying papers containing the particulars of my demands against his Excellency the late Nabob Vizier, and I persuade myself that in such arrangement as you may deem necessary to countenance or recommend for the investigation and payment of his just debts, you will suffer them to obtain their due place.

I will not, honourable sir, trouble you with any explanations of these accounts, believing them to be so clearly stated as to render it unnecessary.

Futty Ghau, 8 February 1798.

I have, &c.
(signed) R. Grant.

No. 9.

Nawab Vizier in Account Current with Robert Grant, Esq.

Dr.

Cr.

	Rs.	a.	p.	Rs.	a.	p.		Rs.	a.	p.	Rs.	a.	p.
To amount of your bond to me on account of the Nabob Nuzuffeer Jung, dated 25th Zekad 1196	-	61,380	-	-			By cash received - - -	10,000	-	-			
To interest on the above sum from 25th Zekad 96 to 15 Mohurren 1798, is 1 year, 1 month, and 21 days, at 12 per cent. per annum	-	8,408	14	9			Deduct batta - - -	476	4	-			
													9,523 12 -
				69,788	14	9	Balance due me - - -	-	-	-			90,265 2 9
To amount of your bond to me, being an account of a house sold to Nabob Muzaffer Jung, dated - - - - -				30,000	-	-							
Lucnow Sicca Rupees				99,788	14	9					Lucnow Sicca Rupees		99,788 14 9

(E. E.)

16 Mohurren 1798,
Hujiree, Futty Ghurr, 31 March 1797. }

(signed) R. Grant.

No. 10.

Nabob Vizier in Account Current with Robert Grant, Esq.

Dr.

Cr.

	Rs.	a.	p.		Rs.	a.	p.	Rs.	a.	p.
To amount of your bond to me, dated 16th Mohurren. 1798, given for the balance of our former account - - - - -	90,265	2	9	By cash received 9th Rebbical Sam, 98 Hageree, Sicca Rs. - - -	5,000	-	-			
				Deduct Batta - - -	240	6	6			4,759 9 6
To amount of interest on the above sum from 16th Mohurren to 9th Shaban, 98, is six months and 24 days - - - - -	6,138	1	6	By interest on the above sum from 9th Rebbical Sam to 9th Shaban '98, is 4 months and 1 day, at 12 per cent. per annum - - -	-	-	-			192 - 3
				Balance due me - - - - -	-	-	-			4,951 9 9
Lucnow Sicca Rupees	96,403	4	3					Lucnow Sicca Rupees		91,451 10 6
										96,403 4 3

(E. E.)

9th Shaban 98 Heigiree, }
Futty Ghurr, 31 March 1797. }

(signed) R. Grant.

No. 11.

Nawab Vizier in Account Current with Robert Grant, Esq.

Dr.

Cr.

	Rs.	a.	p.		Rs.	a.	p.
To amount of your bond to me, dated 10th Shaban 1798, of the Heigiree, on account of former balance - - - - -	91,451	10	6	By balance due me, for which I obtained a new bond from the Vizier - - - - -	1,03,828	1	9
To amount of interest on the above sum, from the 10th Shaban 98 to the 26th Ramezan, 99 of the Heigiree, or 3d August '85, is 1 year 1 month, and 16 days, at 12 per cent. per annum - - -	12,376	7	3				
Lucnow Sicca Rupees	1,03,828	1	9	Lucnow Sicca Rupees	1,03,828	1	9

(E. E.)

Futty Ghurr, 3 August 1795. }
31 March 1797. }

(signed) R. Grant.

No. 12.

Nuvab Asoph ul Doulah in Account Current with Robert Grant, Esq.

Dr.

Cr.

	Rs.	a.	p.		Rs.	a.	p.
To amount of your bond to me dated 3d August '85 or 26th Ramzan, 1199 Hijeree - - -	1,03,828	1	9	By amount received by bills of exchange on Cash-meeree Mull from Hyder Beg Khan, the 1st Regeb 1201 Hejeeeree or Say, 31st March '87 -	1,00,000	-	-
To amount of interest on the above sum from the 3d of August '85 to 31st March 1797 is 11 years, 7 months, 28 days, at 12 per cent. per annum, is	1,45,290	2	2	By amount interest on the above sum from 31st March '87 to 31st March 1797 is 10 years, at 12 per cent. per annum - - - - -	1,20,000	-	-
					2,20,000	-	-
				Balance due to me this day - - -	29,118	3	-
<i>Lucnow Sicca Rupees</i>	2,49,118	3	11	<i>Lucnow Sicca Rupees</i>	2,49,118	-	-

Futty Ghurr, }
31 March 1797. }

(E. E.)

(signed) R. Grant.

No. 13.

Nabob Vizier in Interest Account with R. Grant, Esq. for his share of a Bond to Captain Robt. Frith, Esq.

Dr.

Cr.

	Rs.	a.	p.		Rs.	a.	p.
To amount principal of Mr. Grant's share - - -	80,000	-	-	1792: February -	By received from Nabob Muzaffa Jung, at sundries:		
To interest on the above sum from this date to 8th Knuar 1201 Fussullee, is 7 years and 8 months 8 days, at 1 per cent. per month - - -	73,813	5	6	Sept. 3 -	or 24th Maug 1199 Fussullee - -	34,000	-
				1793: May 5 -	or 3d Knuar 1200 Fussullee - -	21,000	-
				Sept. 27 -	or 9th Bysacks 1200 Fussullee - -	14,327	-
					or 8th Knuar 1201 Fussullee - -	10,673	-
					To interest on 34,000 from 24th Maug 1199 to 8th Knuar 1201, is 19 months, 14 days, at 1 rupee per cent. per month	6,618	10 9
					On 21,000 from 3d Knuar 1200 to 8th Knuar 1201 is 12 months at 1 rupee per cent. per month	2,562	-
					On 14,327 from 9th Bysack 1200 to 8th Knuar 1201 is 5 months at 1 rupee per cent. per month	716	5 3
						9,897	-
					Balance due to me - -	89,897	-
<i>Lucnow Sicca Rupees</i>	1,53,813	5	6			63,916	5 6
					<i>Lucnow Sicca Rupees</i>	1,53,813	5 6

Futty Ghurr, }
30 September 1793. }

(E. E.)

(signed) R. Grant.

No. 14.

Nabob Asoph ul Dowlah in Account with Robert Grant, Esq.

Dr.

Cr.

	Rs.	a.	p.		Rs.	a.	p.
To amount of my salary as assistant to Major William Palmer, as settled by the late Governor General, from 1st September '84 to 31 May 1785 is 9 months at 20,000 sicca rupees per month, per accompanying bill - - -	18,000	-	-	By balance due to me this day - - -	43,560	-	-
To interest on the above sum from 1st June '85 to the 31st March '97, 11 years and 10 months, at 12 per cent. per annum - - -	25,560	-	-				
<i>Lucnow Sicca Rupees</i>	43,560	-	-	<i>Lucnow Sicca Rupees</i>	43,560	-	-

Futty Ghurr, }
31 March 1797. }

(E. E.)

(signed) R. Grant.

No. 15.

STATEMENT of Mr. *R. Grant's* Claim on his Excellency the *Nuvab Asoph ul Dowlah*.

	R.	a.	p.
To balance of our accounts current settled at different periods and closed to 31st March 1797, as per accompanying copies, Nos. 1, 2, 3, and 4 - - -	29,118	3	-
To - ditto - of an account of the principal and interest on my share of a bond given by the Vizier to Captain Robt. Frith, as per No. 5 accompanying -	63,916	5	6
To - ditto - of a ditto - ditto - of my salary when Assistant to the Resident, Major Wm. Palmer, closed to 31st March 1797, as per No. 6 accompanying	43,560	-	-
TOTAL - - <i>Lucnow Sicca Rupees</i>	1,36,594	8	6

(E. E.)

Futty Ghurr, }
31 March 1797. }(signed) *R. Grant.*

Pay the above amount to Captain Rt. Frith, or his order, for value received.

(signed) *R. Grant.*

To his Excellency the Vizier.

To my allowance as Assistant to Major William Palmer, as settled by the late Governor General, from the 1st September 1784 to 31st May 1785, at 2,000 sicca rupees per month, which amounts to nine months, 18,000 rupees.

Lucnow, }
1 August 1785. }(signed) *R. Grant.*

No. 16.

To Major *Robert Frith*.

Sir,

I HAVE the honour of your letter of the 3d instant.

Whatever inclination I feel to assist the recovery of your claims upon the late Nabob Vizier, my interference is precluded by the necessity of an adherence to the rules established for the conduct of the Bengal Government and sanctioned by the orders of the Court of Directors, from which in no instance have I deemed myself authorised to deviate.

I am, &c.

(signed)

Mr. Robert Grant.

Sir,

I HAVE received your letter of the 8th instant.

I am sorry to inform you in reply, that I am precluded by the rules established for the Bengal Government, and sanctioned by the Court of Directors, from any interference to assist the recovery of your claims upon the late Nabob Vizier.

I am, &c.

(signed)

Ordered, THAT the Persian Bond in No. 2, of the English enclosures, be returned to the Resident at Lucknow, with directions to forward it to Mr. Grant.

POLITICAL DEPARTMENT.

The Secretary of State for India to the Governor General of India in Council,
dated 26 May (No. 44) 1860.

1. WITH reference to the Despatch of the Court of Directors in this department, dated the 17th June (No. 22) 1857, forwarding to your Lordship's Government copies of letters and memorials from persons residing in this country, relative to certain alleged claims upon the late native Government of Oude, I now transmit copies of further letters from Mr. T. R. Clark, one of the claimants named in the list forwarded to your Government, but whose case has not yet been reported upon; and I desire that this case, together with any *bonâ fide* claims which may come before you, may be investigated and reported upon with as little delay as possible.

2. In your letters of the 17th May and 8th September 1859, you have reported upon the several claims of the Frith, the Darrell, and the Edwardes' families; but you have not stated the agency which you employed to give effect to the instructions conveyed to you in the Court of Directors' Despatch of the 17th June. The orders of the Court were, that all *bonâ fide* claims against the late native Government of Oude should "be investigated and reported upon, either by the Financial Commissioner of Oude, or by some officer especially appointed for the purpose (acting under the orders of the Chief Commissioner, with such establishment as you may think fit to authorise)." But it does not appear whether the decision conveyed to me in your letters above noticed was based upon a report received from any special Commissioner nominated in accordance with these instructions, and I desire that, with reference to the cases yet to be reported on, this course may be adopted.

I have, &c.
(signed) Charles Wood.

EAST INDIA (CAPTAIN FRITH, &c.)

COPIES of LETTER from Captain Robert Frith to Lord Cornwallis, dated 19 October 1790, with the MINUTE of the COUNCIL at Calcutta thereon, and of the several EXHIBITS annexed thereto; of LETTER from Mr. James Lindsay, Resident at Lucknow, to Mr. G. H. Barlow, Secretary to the Government, Fort William, dated 23 February 1798, together with the several EXHIBITS annexed thereto; also, of LETTER of DESPATCH from the Secretary of State for India to the Governor General of India, dated 26 May 1860, on the subject of the several CLAIMS on the late State of Oude; &c.

(Mr. Ayrton.)

Ordered, by The House of Commons, to be Printed,
22 March 1861.

0.103.

Under 4 oz.

